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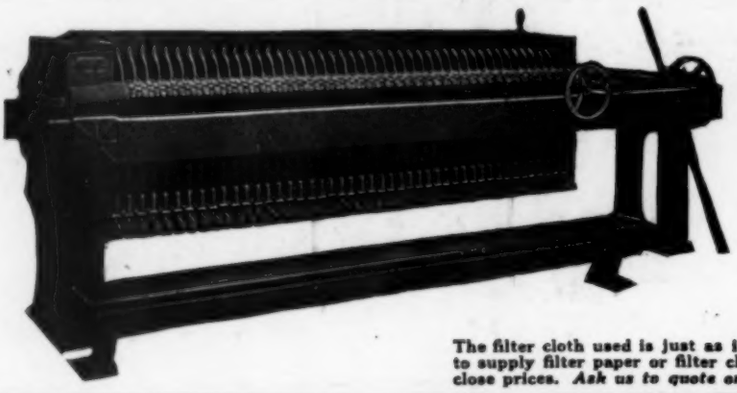

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H. C. PARMELEE, Editor

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The Absurdity Of Dollar Gasoline

POLITICIANS, like the poor, will probably be with us always and their railings will continue sorely to try the patience of a tolerant people. With the adjournment of the Sixty-seventh Congress a sigh of relief went up from the entire country because for nine months at least we are to be immune from the radical eruptions that have characterized recent sessions of our legislators.

Most of the politicians' vituperations have been of a sort we could pass over and forget, for they could be traced to the more or less familiar prejudices and party feuds. On the very last day of the session, however, there was one flagrant piece of abuse that cannot escape without protest. We refer to the infamous report, presumably prepared by Senators LA FOLLETTE and BROOKHART, on the petroleum industry and more particularly to its evident purpose to mislead the public into believing that gasoline will shortly go to a dollar a gallon unless an export embargo is placed on it. Although absolutely no supporting evidence was brought out in the extended hearings before the Senate sub-committee, the politicians nevertheless authorized this conclusion to confirm their earlier charges and to show the world at large that they were taking the part of the poor automobile owner against the great and ruthless oil monopolies.

To the technical man the possibility of dollar gasoline, at least within the present generation, is a positive absurdity. The public's best assurance that the price of motor fuel will not soar to prohibitive levels is in the uninterrupted advance of petroleum technology as reflected in the greater utilization of crudes, in improvements and economies in refining methods and finally in the broadened utility of low-grade products through the development of cracking processes on the one hand and advances in engine design on the other.

Furthermore the production of gasoline substitutes will effectively check any such advance in prices. Industrial alcohol can be produced at a cost not greatly in excess of 25 cents a gallon. While there might be some question as to the immediate supply of raw materials for such a fermentation program, it is scarcely conceivable that there could ever be any permanent shortage of the wide variety of carbohydrate and cellulose materials that can be used for alcohol production. And, of course, our oil-shale resources represent an untapped source of petroleum substitutes that will be developed long before gasoline ever mounts to a dollar a gallon. Our friend Dr. MCKEE estimates that the shale-oil industry can prosper with gasoline at 35 cents a gallon. Nor should low-temperature distillation of coal be overlooked, for here is a demonstrated source of many valuable liquid fuels. Many other lines of fuel research and discovery might be listed, among them the experimental production in France of a synthetic gasoline from crude vegetable oils and the fact that the Germans have hydrogenated coal and coal-tar products to obtain a wide variety of fuels and lubricants. Some of these are still in the hazy status of day dreams, but dollar gasoline would undoubtedly turn many of them into lucrative commercial enterprises.

The whole fabric of the report is political buncombe, however, and as such is unworthy of serious consideration. Our principal complaint is that a legitimate industry has been forced to submit to months of senseless and costly investigation only to find that its case had been prejudged and that the "conclusions" of the committee are but a restatement of individual opinions already aired by the political demagogues.

The Purpose Of a Standard

ELSEWHERE in this issue is a brief statement by W. W. SKINNER, one of the most experienced of the government experts on the establishment of food standards. He discusses this subject with unusual effectiveness, pointing out in his comment with great force the basic reasoning in the establishment of commercial specifications and requirements of food quality.

The arguments advanced by Dr. SKINNER might equally well be applied to the commercial practices of many other industries. Of course the other industries are not subjected to governmental regulation; but the principle of fair relationship between buyer and seller applies equally. It would seem appropriate, therefore, to apply generally the three fundamental considerations which govern the federal officials in their deliberations regarding food standards. These fundamental functions of a standard, paraphrased for general application, are:

1. To define products so as to prevent unfair competition, since one effect of intelligently used standards of trade is the promotion of better business methods and better business ethics.

2. To define products so that inspection laboratories may have a uniform and generally accepted guide in applying the standards to purchases of the products.

3. To define products so that the consumer may discern quality and exercise a discriminating choice, and that the producer may know and meet such a discriminating demand. In other words, to create a condition in the commerce of chemical products where vendor and vendee speak a common language.

We commend these principles to the study of all—particularly to the manufacturers of heavy chemicals.

On the Comforts Of Patience

THE news is going around of a French invention to make artificial wool out of cotton by impregnating the fiber with a protein substance such as glue, gelatin, egg albumen or casein, which has first been broken down by an acid and then rendered insoluble in a water bath. Good wearing qualities and other merits are claimed for the new fabric.

We have no patience with troublesome skeptics that are constantly discouraging faith in invention and research. We have always felt that once the problem of the cellulose molecule is solved, we may look for all sorts of new fabrics and new materials. This invention comes a little early, but we wish to record our faith in the advent of artificial wool eventually, and to admit that some day desirable fabrics may be developed by a proteinizing process with cellulose. But development is always slow and painful. Sometimes it pays to wait! In the meantime we are not planning to array ourselves during the hot weather next summer in a suit of cotton clothes impregnated with glue. We should grow a little nervous over the possibility of sticky sequelæ of photochemical reactions as we pursue our way along the hot humid streets toward Tenth Avenue and 36th Street.

An Achievement in Current Statistics

WE HAVE often referred to the value of statistics, particularly when they are issued in time to be of current interest to industry. In this connection a recent achievement of the Chemical Division of the Department of Commerce is worthy of special comment. Statistics for the coal-tar dyes imported through the port of New York during the month of February, 1923, were carefully compiled from the customs invoices, analyzed by the dye experts of the Commerce Department and the United States Tariff Commission, and made available in mimeographed form on March 6. Certainly this is an example of dispatch which other governmental agencies might well emulate. And the statistics themselves were not mere totals of poundage and value. In addition to such figures each dye was classified on the basis of its chemical composition and listed according to its Schultz number; the usual trade names were given, also the name and address of the foreign manufacturer and, finally, the percentage of quantity by the countries of origin. A small proportion of the entries, which could not be identified on the basis of the Schultz Farbstoff Tabellen, were grouped according to their method of application—that is, as acid, basic, vat, mordant, chrome or sulphur colors.

But it may be asked, Is all the detailed work entailed in this compilation and the department's special effort to issue it so promptly really worth while? The answer, we believe, is to be found in the significant information brought out in the February report. During that month $52,000 worth of imported dyes, or 26.2 per cent of the total, came from Italy, or was sold on the American market by Italian concerns. That fact is worth looking into, for Italy has never been regarded as a serious competitor of the I.G. The department's detailed data on the dye manufacturers, however, show that practically every pound of the Italian shipments, and a large proportion of those imported from France, were actually made in Germany. They were products granted the Italian Government as reparations and resold to American importers in order to realize their gold value. The treaty of Versailles especially provides against the resale of reparation products, but since we are not a party to that treaty we can have no grounds for an official complaint. Furthermore, the practice has already become quite general in the case of pharmaceuticals and apparently with the consent of all interested parties.

The second significant deduction from these statistics is proof of the unhappy effect that the French occupation of the Ruhr is having on the dye industry of Switzerland. Apparently the Swiss manufacturers are suffering severely from interruption of their supply of crudes, intermediates and other raw materials which usually originated in the occupied region of Germany. The amount of Swiss dyes received by the United States in February was only 10.4 per cent of the total. In the year 1921, 40.5 per cent of our dye imports was of Swiss origin.

These are facts that are of immediate importance to the domestic manufacturer of dyes and coal-tar products. At the same time they are indisputable evidence of the value of current statistics. The Department of Commerce and the Tariff Commission are to be congratulated on their excellent work, and it is to be hoped that eventually the reports may be extended to cover all of the important products of American industry.

Congress Adjourns

THE dust and smoke from the battle of the "blocs" has now settled sufficiently to permit at least partial appraisal of the outcome of the contests that were waged so violently in the last Congress. Perhaps the most conspicuous conclusion that a fair-minded appraiser reaches is the fact that this Congress was divided into groups having common interest, and not ruled by the customary party system.

Those who have opposed FORD'S Muscle Shoals proposal and the other variations in contract for lease or for sale of the power and the nitrate properties in that locality finally can rest in comfort for some months. The Congress which just closed left the situation substantially where it found it, for the Wilson Dam construction is continuing, the nitrate plants still belong to the government, and the disposal of the power from this huge development is still to be determined. In failing to secure any action upon Muscle Shoals the agricultural bloc failed in one of its most cherished objects. This same group also failed to enact the legislation providing ten million dollars for the purchase of calcium arsenate and nitrates for resale to the farmers at cost. These are two striking evidences that the interest of a single group in the community, powerful though it may be, does not dominate the Congressional situation wholly. It may obstruct, but it can seldom enact.

At the end of the session there remained without action the legislation on reclassification of the government service. Also no final action was taken on the proposed National Hydraulic Laboratory, though a favorable report to the Senate was secured. The bill proposing conservation and development of helium resources also failed through faulty management. After full and apparently very satisfactory hearings before the Public Lands Committee of the House, this bill was never given further attention because the commit-

tee finally decided that it was without jurisdiction in the matter and that the Committee on Military Affairs would have to begin all over again in the next Congress. Another bill that failed to get action in closing days was the bill for the regulation of radio communication.

Taken all together the Sixty-seventh Congress undoubtedly faced problems of exceptional magnitude and exceptional difficulty. It accomplished some things. In many more particulars it failed of accomplishment.

One feature, however, of the work of this Congress holds definite promise for chemical industry. Forced largely thereto by the Fordney-McCumber tariff act and the Muscle Shoals impasse, this Congress has given vastly more hours to the debate of chemical and chemical engineering matters than any of its predecessors. While the immediate outcome of this debate may not be wholly to the liking of those affected, still they can console themselves that they suffer in a good cause. Chemical industry needed a press agent and the Sixty-seventh Congress, following after the recent war, has proved the best it ever had.

Why Did It Break?

TWO years ago we commented editorially on the great number of unsolved and obscure problems concerning the endurance of metal to repeated loads. They appeared to be so numerous that solution by series of direct experiments—and what experiment requires more time than 100 million cycles?—seemed impossible. At that time a logical explanation of the mechanism of fatigue was in hand, but unfortunately we had no "conversion factors," so to speak, whereby we could predict the behavior of a given metal from easily determined physical properties.

In the meantime it has been proved to everybody's satisfaction that elastic metal can endure so-called "fatigue stresses" indefinitely, provided they fall within the safe range. In other words, there is no reason to fear eventual rupture of the most carefully designed and fabricated turbine shaft, even though it run on and on for years. BAUSCHINGER—one of the earliest investigators—proposed the theorem that the elastic range and fatigue range are identical. If elastic limits are taken from a tension test bar, this statement does not correspond to experience—hardened steel or annealed copper does not deform in an elastic manner—that is, the stress-strain curve really *curves* from the origin—yet both of these metals have been shown to have endurance properties as well defined as wrought iron.

Professor JENKIN, of Oxford, has recently constructed a little model which explains this apparent anomaly, and in fact will probably furnish engineers the "conversion factors" long wished for. Like all inspirations of genius, it is beautifully simple, and represents the action of crystals as they slip when overloaded. It can be set so that any crystal can have any desired internal strain, short of its own elastic limit in either compression or tension. Then its action on the aggregate—the metal piece—can be observed.

This model confirms BAUSCHINGER'S theorem entirely. It is only to be noted that the elastic limit referred to is the elastic limit of the weakest crystal in the metal. That fact we could have assumed from the microscopic work of EWING, ROSENHAIN and HUMFREY, who discovered the facts now contained in all our textbooks: that a fatigue failure starts in a crystalline slip, which gradually opens up into a crack and extends itself by splitting. Clearly slip will occur when the weakest crystal, the crystal least favorably disposed to stress, or the crystal bearing the greatest "internal strain," becomes loaded beyond its elastic limit.

What, then, goes on in hardened steel, which apparently has no elastic limit? It is a crystalline aggregate, and crystals are elastic. Experiments with the model indicate that when the crystals are stressed in all sorts of ways—some almost ready to split by tension imposed upon them by their neighbors, others working almost to their limit in compression, and the remainder with every intermediate amount—at the first increase of external load the worst-loaded crystal slips; with increasing loads more and more of the crystals less stressed initially reach their limit and slip, and so on. Plastic deformation (in part) starts from the beginning, and continues at an increasing rate. Hence, the model duplicates the stress-strain curve for hardened steel or copper. It has no straight beginning. But if the increase in load is at a moderate rate, is interrupted by rest periods, or if the day is pretty hot, the amorphous metal generated by the slips should recrystallize, and the overloaded crystals should heal, but now in the stress-free condition. Consequently, if the metal is then tested in tension, it should behave in an elastic manner as far as the previous fatigue load. And it does! By gradually increasing the fatigue load by steps—and this has also been proved by experiment—the metal can therefore be "fatigue hardened"—i.e., have all its crystals brought into the stress-free condition—and the fatigue limit would then be increased to correspond with the yield point, perhaps 20 to 30 per cent above the ordinary value.

Repeating the original heat-treatment spoils this gain, of course, for it puts into the metal the internally strained condition it had at the start. Here we pause for more information. It is easy to see how quenched alloy steel has severe internal strains, caused not only by volume changes due to differential thermal expansion, but also to partly finished transformations. But why should annealed copper?

That question can be answered by studying copper. At present we welcome the information given by these experiments. It is well known that the marine engineer brings up his engines by slow degrees and short trials, finally reaching full load. It helps run in the bearings of course, but, far more important, gives time and opportunity for the metal to slip into the unstrained condition. A proper start may add 20 per cent to the engine's strength.

Some mining companies buy crusher shafting by the carload, keeping spares on hand ready for the expected break (by "crystallization," as they call it). Starting off at full capacity, these machines are quickly and violently overloaded when cracking a big rock. Professor JENKIN'S model and the actual experiments it foreshadowed show that such usage will reduce the endurance limit 40 per cent of that when properly "fatigue hardened." Would it not be worth while to run these shafts in by short campaigns on carefully screened and sized rock?

Finally, spring manufacturers will do well to study the possibilities of the new method. Apparently in no class of steel is correct preparation by mechanical stressing more important than in heat-treated alloy steels. In fact, mechanical treatment appears to be as important as heat-treatment. And every one knows that automobile springs fail now and then.

Readers' Views and Comments

Dirt

In Steel

To the Editor of Chemical & Metallurgical Engineering

SIR:—The micrographs in the letter signed Martin Seyt in your issue of Jan. 24, showing inclusions in what was supposedly a tool steel and in an alloy steel shafting, although they served to emphasize the important bearing of inclusions on the quality of steel, seem to the writer rather unfortunate as examples, in that the polish was very poor and the magnification not stated. That these points are not trivial will be plain from the micrographs shown herewith.

The specimen from which the micrographs submitted were taken was a piece of rail steel (approximately 0.70 per cent C). The same spot is shown in all. However, the same inclusions are not shown in Figs. 1 and 2 as in Figs. 3 and 4, since the specimen was ground down somewhat after the quenching and previous to repolishing. For Figs. 1 and 2, the polishing of the specimen was purposely done incorrectly. One of the steps in the polishing procedure of the Bureau of Standards was omitted, the specimen being taken from the OF emery paper to the SF emery wet wheel (3F Alundum omitted) and after that polished for an insufficient time on the final alumina wheel. For Figs. 3 and 4, the sample was repolished correctly after being quenched from 800 deg. C. in water. The quenching is not essential, but it has proved advantageous at the bureau in similar examinations, since after the hardening the steel surrounding the inclusions is not so easily abraded away. The pit which invariably forms about each inclusion during polishing is then not very large and each inclusion is sharply outlined. Also the emery used in polishing does not become imbedded in the hardened steel as may occur in a soft steel and the particles of emery might be taken for inclusions.

Certainly an erroneous conclusion might be drawn by

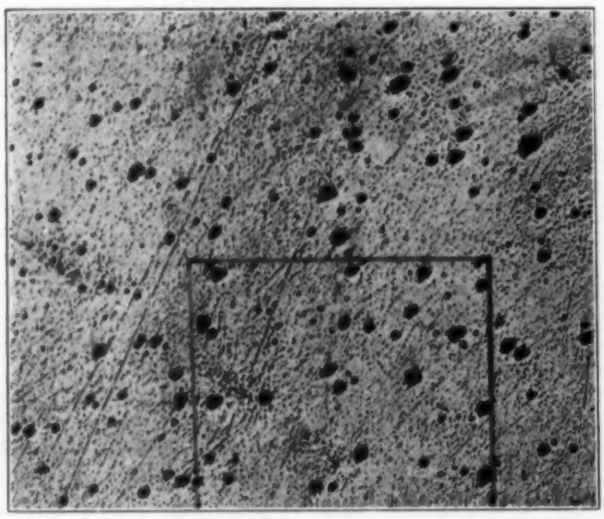


FIG. 1—RAIL STEEL INCORRECTLY POLISHED. × 50

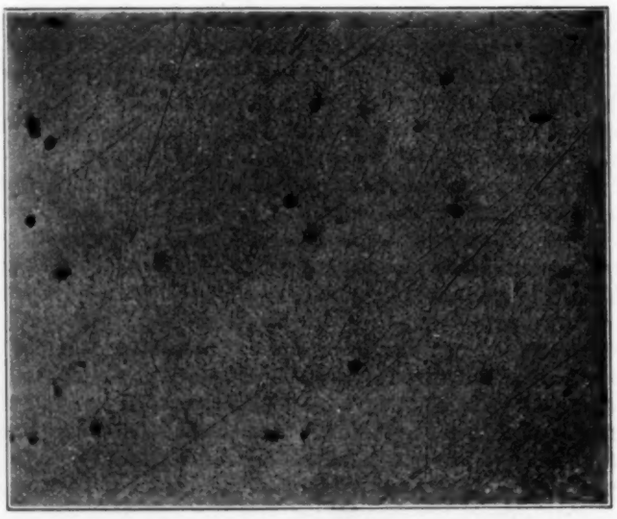


FIG. 2—SAME SPOT. × 100

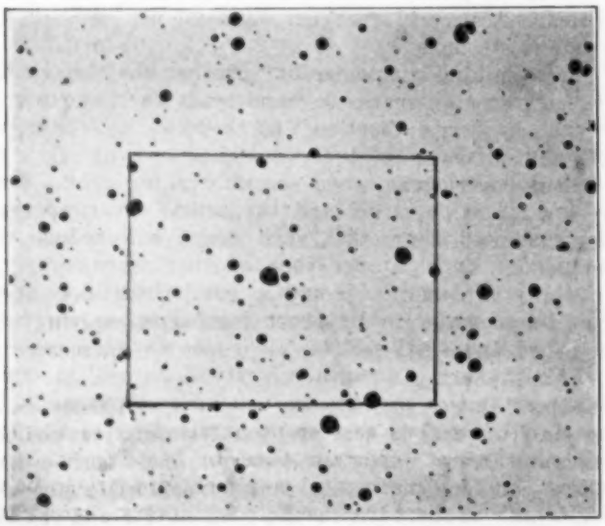


FIG. 3—SAMPLE QUENCHED AND REPOLISHED. × 50

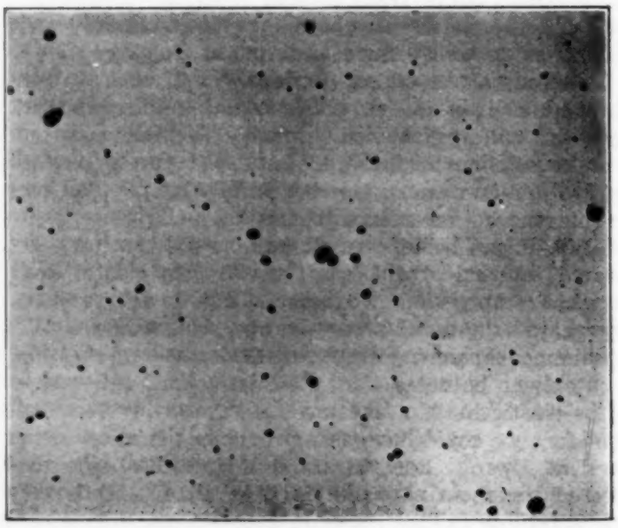


FIG. 4—SAME SPOT. × 100

judging the quality of the steel from the appearance of Fig. 1. In a cleaner steel and in a softer lower carbon steel, the difference between Figs. 1 and 2 and Figs. 3 and 4 could be even more striking. That it is necessary to state the magnification is evident if the appearance at 50 magnifications is compared with that at 100. in the same surface area there are four times as many inclusions at 50 magnifications as at 100. The area in the square at 50 magnifications makes up the whole micrograph at 100. The size of the inclusions appears almost the same at both; if anything, it is smaller at 100. This is an optical effect, a result of the slight pitting around the inclusions which cannot be avoided.

In metallographic examinations a study of the inclusions is of the utmost importance, and even more care should be used in the preparation of the specimen for observation of the unetched structure than for the examination of the structure as revealed by etching.

Associate Physicist,
Bureau of Standards,
Washington, D. C. SAMUEL EPSTEIN.

Shore Scleroscope

To the Editor of Chemical & Metallurgical Engineering

SIR:—Noticing your article on the new model scleroscope in your issue of Feb. 14, I am reminded of the fact that I met Mr. Shore somewhere in Brooklyn when he had just completed his first instrument. In conversation with him he gave me a few of his pamphlets and asked me if I could interest some business acquaintances, and he offered me a 15 per cent commission for selling the instrument. I perfectly recall the opposition I received from various men whom I talked with regarding this scleroscope; like everything new, they laughed at it and said it was of no use to them.

This is interesting, as I have learned that at Bridgeport they have reversed the principle and are testing the hardness of steel balls for roller bearings by bouncing them over a hurdle. I merely mention this as, perhaps, a note of interest to show the progression and growth of an idea.

GILBERT E. STECHER.
Weehawken, N. J.

Food Standards*

BY DR. W. W. SKINNER
Assistant Chief, Bureau of Chemistry

AN intelligent and effective enforcement of regulatory laws requires the formulation of definite standards. Standards would necessarily be developed but gradually and laboriously by precedent, by official fiat, or by specific legal enactment, were there no definite organization specifically constituted for the purpose, since a standard is, in many instances, the fundamental starting point in the determination of whether a food product conforms to the provisions of law. However, I believe there is quite prevalent a misconception of what a standard is or ought to be. This is because the word standard is an unfortunate one for our purpose, since the older and more common use of the word standard connotes superiority or a special mark of excellence. Thus, for instance, a standard meter stick or a standard pound weight indicates a unit of measure of unusual precision or accuracy.

A standard for a food product has quite a different significance, and indicates a limit or a point from which to measure. It is a zero point, as it were, above which products are acceptable if considering desirable constituents and below which they are to be rejected. Thus it is that a product which complies with a specification may be very much short of a really excellent or superior product—indeed, it may be as judged by popular conception a rather inferior product, yet comply with the standard specifications.

The recently issued and much discussed standard for milk bread well illustrates the point. The Joint Committee, after more than 2 years of consideration of the bread schedule, concluded that a bread made from a dough in which one-third of the usual water had been replaced by milk was entitled to be designated milk bread. I am not, I hope, violating any confidence when I express the opinon that probably every member of the committee personally prefers a bread with a higher content of milk solids than is represented by the use of one-third milk, and will welcome the opportunity to change the standard to include an additional amount of milk when the trade practice has been so improved as to make such a standard feasible. I cannot in brief limits attempt even a summary of the evidence which led the committee by a unanimous vote to define milk bread as noted above, and must be content with the assertion that the evidence was convincing to the committee that a consumer would have no reason to feel deceived or defrauded if sold a product as milk bread which conformed to these specifications.

The Food Standards Committee is a court where the evidence affecting a proposed schedule is carefully considered and where a judgment is rendered based upon the evidence presented. The administrative machinery of the committee has been developed to a point where it is believed we are getting the full evidence before the committee in the most effective way. Food officials, manufacturers, producers, distributors and consumers are given an opportunity to present their views and to criticise a proposed definition or standard.

The original Standards Committee with painstaking care and with a clearness of vision as to needs almost prophetic adopted certain principles as a guide for the action of the committee, and these principles unaltered are still the guide for the committee's action. A careful consideration of these principles will convince any one, I think, that it was not the conception of the members of the original committee or of the committees which have followed that it ever was or has been the function of the committee to erect or create arbitrary ideals and then attempt to translate such ideals into standards.

The three fundamental considerations which govern the committee in its deliberations and conclusions in formulating its definitions are:

(1) To define products so as to prevent unfair competition, since one effect of intelligently enforced regulatory food laws is the promotion of better business methods and better business ethics.

(2) To define products so that food officials may have a uniform and generally accepted guide in applying the general provisions of regulatory laws to commerce in food products.

(3) To define products so that the consumer may discern quality and exercise a discriminating choice, and that the producer may know and meet such a discriminating demand. In other words, to create a condition in the commerce of foods where vendor and vendee speak a common language.

*Statement in *Food and Drug Review*, the "house organ" of the Bureau of Chemistry, February, 1923.

British Chemical Industries

Some Effects of the Ruhr Occupation—The British Industries Fair Has Some Notable Exhibits

FROM OUR LONDON CORRESPONDENT

LONDON, Feb. 20, 1923.

THE official figures for chemical exports in January have exceeded all expectations in showing a 40 per cent increase over December and in being the best recorded for more than 2 years. The home trade has also shown expansion, consumption of heavy chemicals for the iron, steel and paper-making trades having improved. As was expected, the situation in the Ruhr and the subsequent occupation of German dyestuffs and fine chemical factories have given a firmer tone to the fine chemical market, but without much effect for the present upon the volume of business transacted. Coal-tar products, and particularly carbolic acid crystals, are naturally scarce. The position as regards dyestuffs is distinctly interesting, because just at the moment, when intensified propaganda in favor of the repeal of the dyestuffs and safeguarding of industries acts was about to be launched, consumers find themselves in the invidious position of being again dependent for an indefinite period upon British makers, with the added uncertainty as to whether reparation dyestuffs, should such continue to be forthcoming, might be allocated mainly to British markets. The settlement of the terms for the funding of the British debt to America is expected to react beneficially upon chemical industries in spite of the further rise in the dollar exchange.

"BETTER AND BIGGER" BRITISH INDUSTRIES FAIR THIS YEAR

This month's letter has been held up a few days in order to include a brief note upon the trade show at the White City, which was opened by the King this week and which for the second time includes a well-organized effort bringing British chemical industries into adequate prominence. The details of individual exhibits can be best appreciated by readers of *Chem. & Met.* by reference to the trade press, and no pen picture can take the place of an actual visit. Suffice it to say in general terms that the present fair has been made more attractive than usual and shows a distinct advance on that of the previous year. There is a certain sameness about all stands and booths at trade exhibitions all over the world and the usual unattractive methods of description and stereotyped display are still with us and perhaps rightly so in a case where buyers and not the general public are admitted.

Dyestuffs are attractively shown and are really quite impressive. The British Dyestuffs Corporation shows Ionamine B, the first of a new series for dyeing cellulose acetate silk, and the alkali works and gas companies exhibit new ranges of intermediates, including chloranilines. In the fine chemical section Typke & King have an attractive exhibit of rubber substitutes and rubber makers' chemicals and Messrs. Tyrer show a new range of cobalt and nickel ammonium citrates. Pure glucose, now used in medical and surgical practice, is shown by British drug houses, which have also undertaken the manufacture of research chemicals of all kinds. May & Baker have an attractive exhibit of pure camphor that is sublimated direct into cubes. These cubes are wrapped out of contact with air and moisture direct into colored, transparent wrappers impregnated with "Callophane," an acetyl cellulose varnish marketed by Cellon, Ltd., which has been developing its Cerric lacquers and colors with considerable success. The chemical plant section includes standardized jacketed and enameled pans and the Plauson and Premier mills, with a remarkable series of samples of products obtained by their aid. The Kestner Co. shows its new glandless acid pump, which works with a silicon iron plunger, lubricated by acid leaking past it at a slow and steady rate, and laboratory suppliers are also well represented.

VULCANIZED RUBBER LATEX: A COMMERCIAL PROBABILITY

Further details have been privately circulated regarding the vulcanized rubber latex process mentioned in my last letter. A holding company, Vultex, Ltd., has been registered, with a strong board of directors, to develop Dr. Schidrowitz's invention, which may briefly be described in that rubber latex can be vulcanized as such and yet be maintained as a stable liquid, the crude rubber being converted into vulcanized rubber without coagulation taking place. The colloidal suspension is obtained by vulcanization with sulphur and other agents and heating in open steam to vulcanizing temperature in the presence of an accelerator, and the product is indistinguishable even under the microscope from the raw latex. When the vulcanized latex is evaporated, a film of rubber is recovered, which shows excellent recovery after stretching, and swells but does not dissolve in rubber solvents. It is claimed that the vulcanized latex can be readily transported and stored, that the strength of the rubber films is superior to that obtained by other methods, that the proofings have no smell and do not go hard in cold weather or become tacky at low heats. They resist oil and grease and for nearly all manufacturing purposes considerable economies can be effected in manipulation. Experiments have shown considerable advantages in the manufacture of cords and fabrics for tires, for proofing operations of all kinds and in the manufacture of waterproof adhesives for posters, bill sticking and the like. It is understood that subsidiary companies will be formed at an early date for exploiting the process in this and other countries, and naturally further information is awaited by the trades concerned with great interest.

INTEREST EVIDENT IN THE NEW ELEMENT

Even the lay press gave prominence to the proceedings at the Chemical Society when a small quantity of cinnamon-colored powder, the oxide of the new element tentatively named hafnium, was shown and the story of its discovery almost simultaneously here and in Copenhagen was discussed. The raw material is a black iron sand found in New Zealand, which is titaniferous and said to occur in a belt 70 miles long. The atomic weight has been calculated as 175 and the element identified as belonging to the titanium-zirconium group, with this difference, that it does not appear to form a double fluoride. It is not yet clear whether this discovery is likely to be of commercial importance in the direction of incandescent mantle or other manufactures, and of course there is the usual controversy in regard to an appropriate name. Even if it should remain a chemical curiosity, there is always something stimulating about the discovery of a new element, even before it is actually isolated, and Dr. Scott's generous action in placing supplies at the disposal of Koster & Hevesey at Copenhagen is universally approved.

Nichols Medal Awarded to Thomas Midgley, Jr.

Twentieth Anniversary of Original Presentation Goes to Engineer and Prominent Investigator in the Field of Gaseous Detonation—Address of Acceptance Reviews Anti-Knock Properties of Matter

BEFORE a notable assemblage of chemists in Rumford Hall, New York City, on March 9, the New York Section of the American Chemical Society awarded the Nichols medal to Thomas Midgley, Jr., chief engineer, fuel section, General Motors Research Corporation. The event marked the twentieth anniversary of the first presentation of the Nichols medal, which is awarded annually for the best original paper that had been published during the preceding year in any one of the three journals of the American Chemical Society. It was the unanimous judgment of the jury of award that this year the honor should go to Mr. Midgley's article on "The Chemical Control of Gaseous Detonation, With Particular Reference to the Internal Combustion Engine."

In his introductory remarks Dr. C. A. Browne, chairman of the New York Section, recalled that the medal had been established in 1902 through the generosity of Dr. William H. Nichols, past president of the American Chemical Society. The first presentation was just 20 years ago—in 1903. Under the original conditions the medal was awarded for the best paper given before the New York Section, but in 1913 the requirements were broadened to their present national scope. It was significant, Dr. Browne declared, that this year the award had been with the unanimous approval of the donors and had already received the popular assent of the chemical profession.

Midgley and His Work

"A mechanical engineer by education, yet one who quotes the periodic law freely and one for whom organic chemistry presents no terrors, such a man is Thomas Midgley, Jr.," said Professor Bancroft. "His career is the more extraordinary because he has thus upset all precedent."

Graduated from Cornell in 1911, thereafter employed until just prior to the war in connection with the rubber industry, Midgley's progress has been very rapid. Dr. Bancroft would attribute his success to his ability to correlate apparently meaningless and hopelessly scattered facts. He showed how from several different sources he has gathered together the disconnected fragments which first found expression in his working hypothesis and which have resulted in notable success in his work upon anti-knock mixtures.

Without knowing anything of the mechanism of reactions of mixtures undergoing combustion within fixed space limits, Midgley set out to study the rate of reaction under varying conditions and to analyze the phenomena of detonation in gaseous mixtures. Benzene and kerosene were used as fuel in these experiments. Investigation showed that the introduction of a foreign substance into the fuel mixture, even in minute amounts, would affect detonation, or knocking. Organic compounds of Se, Te, and especially of Pb, affected this property of knocking very appreciably. Tetra-ethyl lead entirely did away with the knock or detonation wave—in other words, the combustion of the fuel was complete before detonation occurred. A fraction of 1 per cent of these substances—as for instance, 0.04 per cent of $Pb(C_2H_5)_4$—in the fuel mixture completely eliminates the knock.

Dr. Bancroft pointed out that the significance of Midgley's work is to be far reaching. By decreasing the rate of reaction and thus allowing complete combustion of a fuel mixture, the compression is greatly increased. The saving effected means using much less fuel. In other words, Midgley's work may actually double the existing fuel supply. Unfortunately the existing type of motor in general use will not stand the compression required for the efficient use of anti-knock mixtures, and as a result the full value of the work done will not become apparent for some time.

In concluding his remarks Dr. Bancroft summarized the difficulties overcome by Midgley, commended him highly on the clear-cut manner in which his work has been carried out and congratulated him on the splendid success achieved.

Dr. Herty Presents Medal

Dr. Charles H. Herty, past-president of the New York Section, made the presentation. He called the roll of the distinguished investigators who have previously received the medal in order not only to demonstrate the esteem in which Midgley's work is held but also to emphasize the fact that his success has been attained at a comparatively early age. Best wishes for continued achievement on the part of the section attended the medal, Dr. Herty said, in making the presentation.

Acceptance and Address

In accepting the signal honor accorded him by the society, Mr. Midgley said that it was with a feeling of deepest humility that he recalled the names of the eminent investigators who were his predecessors as Nichols medalists. He asked, therefore, that he be allowed to receive the medal in the name of the organization represented by his faithful and industrious coworkers in the laboratories of the General Motors Research Corporation.

The acceptance address, entitled "Some Fundamental Relations Among the Elements and Compounds as Regards the Suppression of Gaseous Detonation," was

interpreted by Mr. Midgley in an informal discussion of the anti-knock characteristics of matter. At the outset he defined anti-knock as a property of matter whereby a material acts either as a negative or positive catalyst in the prevention of detonation in the internal combustion engine. This property is believed to be possessed by all of the elements provided the right compounds can be obtained. So far the investigations at Dayton have demonstrated that the property exists in the case of twenty-two elements and additions are constantly being made to the list. To be sure, certain compounds such as ethyl nitrite show the property in a negative sense and are referred to as negative catalysts, since they accelerate rather than suppress detonation.

The marked effect of the presence of a small percentage of diethyl selenide, one of the more important anti-knock materials, was demonstrated on the lecture platform by the combustion of a detonating mixture of acetylene and air. Tetraethyl lead, an even more powerful material, could not be used in this particular experiment because of its lower volatility.

THOMAS MIDGLEY, JR.

Theories of Detonation

Mr. Midgley then reviewed certain of the theories which have been advanced in explanation of the detonation phenomena. He also showed the mathematical development of the equation generally accepted as an expression of the relation between the reaction velocity and the pressure in the wave of detonation. Those who were intertested in the thermodynamic phases of this subject were referred to Mr. Midgley's original publications in the *Journal of the Society of Automotive Engineers* and the *Journal of Industrial and Engineering Chemistry.*

In brief, the accepted theory of detonation is this: During normal combustion the differential between the pressure in the rear of the flame of propagation and the pressure in front of the flame is almost insignificant, its magnitude being less than 1 lb. per square inch. If, however, the flame front is caused to move forward at an extremely high velocity, as during detonating combustion, the pressure differential becomes enormous and the flame front is preceded by a region of dense gas at an extremely high pressure. The metallic sound, which we commonly call the knock, is caused by the impact of this high-pressure, high-velocity wave with the top and sides of the engine cylinder.

Significance of Atomic Groupings

It has been the plan of these investigations to study a great many anti-knock compounds particularly in relation to the influence of atomic groupings on the detonating effects obtained. The hypothesis has been advanced that the anti-knock property resides in the atom of the compound rather than in the compound as a whole. An example of the manner in which the groups modify the anti-knock property of the element is shown in the following table, which compares the relative effectiveness of three strong and one weak anti-knock elements with aniline as a standard of comparison.

The figures given are the reciprocals of the number of gram molecules required to give an anti-knock effect equivalent to that of 1 gram-mol. of aniline. The negative in the case of ethyl ether means, of course, that this compound accelerates detonation.

Element	Derivative C_2H_5	Derivative C_6H_5
I	1.09	0.88
Se	6.9	5.2
Te	26.8	22.0
O	—0.046	0.122

A study of valence and bonding conditions in a wide variety of compounds has brought out a number of significant principles. The influence exerted on the detonating effects of the compound by the different atomic groupings was shown in a chart giving the anti-knock values of a number of elements when combined with hydrogen, alkyl and phenyl groups. Important studies have been made with the derivatives of carbon with the idea that the fuel itself may possess special anti-knocking properties. Starting with aniline (6C) and continuing with toluidine (7C), xylidine (8C), etc., it was found that the number of carbon atoms in the molecule bore a definite relation to the anti-detonation characteristics of the fuel and this relation could be plotted to yield smooth curves.

In concluding his address, Mr. Midgley stressed the fact that much more investigation was necessary to round out and complete the work on the chemical control of gaseous detonation. As is usually the case with pioneering in any field, the work of Midgley and his associates has blazed a trail through a fertile field of investigation. Others must follow. Many interesting problems are yet to be solved.

Important Gift to British Society

Sir Alfred Yarrow has presented $500,000 to the Royal Society for the promotion of scientific research, and in conveying his gift, records his conviction that a patriotic citizen cannot do better than give money for "the development of science, upon which the industrial success of the country so largely depends."

The Commercial Banker's Function In Business

An Interview with William Post, Chairman of the Executive Committee, Central National Bank of Philadelphia

BY CHARLES WADSWORTH, 3D
Assistant Editor of *Chemical & Metallurgical Engineering*

PERHAPS it was an unwarranted assumption that the engineer is almost completely unfamiliar with the practice and theory of commercial banking. If it was, we beg to assume the entire responsibility for it. During our interview Mr. Post was most patient in answering the questions which were asked, and the questions were those of a man without experience or contact with the field of commercial banking.

Not unnaturally the first question had to do with the function of the commercial bank as far as industrial plants are concerned. In reply Mr. Post remarked that some, perhaps many, people believed that the commercial bank actually financed new ventures, supplying the necessary first capital for establishing a business. This of course can never be the case, as a brief consideration of the situation will show. The funds at the bank's disposal are funds deposited with it by its clients to be repaid upon demand—lodged with the bank for safe keeping.

Of course, good banking practice as well as government regulations provide that a definite cash reserve on deposit be maintained. The remainder of the money on deposit is available for loans and other investment. But let us assume that a bank were permitted to make loans on long-time credit or even to contribute a part of a capital investment. What would happen? For one thing, a certain part of the loans made as capital investment would be lost in new ventures, because of unforeseeable risks. In other words, part of the depositors' money would be gone or the bank's working capital impaired. The risk in such investment is no part of commercial banking. Similarly during the life of a long-term credit loan it is possible for conditions so to change that the lender bank would find it necessary to liquidate its investments because of an imperative demand for cash. So it is the result of seasoned experience to place a time limit on commercial credits, which is usually from 90 days to 4 months and should not even in exceptional examples exceed 6 months.

Thus it will be seen that contrary to a widespread impression a commercial bank does not and should not play any part in the establishment of industrial enterprises. An inventor or engineer who has an idea and no money must not expect a bank to finance him. The original capital should come from investment channels—individuals or stockholders.

A bank may begin to assist an enterprise after it has been successfully started and it should and will continue its assistance and support as long as the business remains healthy, vigorous and honest. Sometimes it is necessary for banks to stick by old clients when they are in a tight place. This will be to protect a good client unavoidably drawn into a rather hard situation, or to protect loans already made. Except for such instances a commercial bank must confine itself to liquid business; it is in no sense a doctor for sick business, though it will foster and aid new business up to a safe point.

What, then, are the criteria developed for evaluating a business from the banker's standpoint? How shall the banker decide to grant or not to grant a loan?

This, Mr. Post remarked, is the whole problem of commercial banking in a nutshell. In such an interview as this it is possible only to indicate the kind of estimate which the banker must make. To develop the subject adequately would require a volume, and even then the text would be colorless. Commercial credit is a problem of individual cases and only the most flexible type of generalization can be made. The variables are many and any effort to reduce the problem to rigid mathematical determination will result in unsafe banking. Woe betide the banker who looks only at the financial statements of an enterprise without full knowledge of the men behind the statement, for

"When in Rome, Do as the Romans Do"

So runs the proverb, and it is sane advice, but inadequate. It makes no provision for finding out what the Romans do nor how they do it. Our suggestion would be to corral a wise Roman and get him to teach you what and how.

When we wanted to find out how a man or a corporation could borrow money from a bank to keep a chemical plant going, we went to a banker. Said he: "The subject of commercial credits is exceedingly intricate. By the way, have you read the 'Four C's of Commercial Credit,' by William Post? Well, you ought to read that first." Without more ado we took a train for Philadelphia and had a talk with Mr. Post. So it was we found our wise Roman.

For over 50 years he has been a banker, a human banker who will not reduce commercial credits to mathematics, and the substantial growth of the bank shows the wisdom of this course. He was one of the pioneers in credit analysis and his rich experience is projected for a fortunate community in his book. His spirit is a type of leaven which the business community needs.

financial statements are only as dependable as their authors.

The banker looks for three things in a prospective borrower. They are Character, Capacity and Capital. These, with the fourth "C"—Collateral—are the four big factors to be considered in extending bank credit. Capacity alone is distinctly a dangerous prospect, for an unscrupulous operator with plenty of ability, though he may pay bills as a matter of policy until a pinch comes, may then not hesitate to conceal quick assets and leave the creditors a meager skeleton to pluck. So too Character alone would frequently be unable to meet his debts—and Capital unsupported by Character and Capacity finds himself a mendicant more frequently than not.

If Character and Capacity be linked, the banker has a very fair prospect. When supported by these, even limited capital may satisfy the banker that his support is merited. The mathematical banker may shake his head and say "No" when a more human confrère will win a lifelong friend and a strong account for his bank by encouraging a loan to the comparatively new business, accompanied by modest capital. Let Capital be linked with Character and Capacity and the combination can be beaten only by the addition of undoubted Collateral to the group, in which case the commercial loan should be most secure.

Collateral a Quicksand

Before discussing a few of the significant phases more specifically it should be remarked that collateral is a quicksand which it is necessary to scrutinize with experience and care. Collateral loans are much sought after by banks, and yet it is probable that more losses result from them than from straight single name paper. The reason for this seems to be that collateral loans are made up on many types of collateral—nor are they watched with as great care as other loans. The collateral is taken in at a desirable margin, but the bank often neglects to check the intrinsic worth in the collateral or to note its fluctuations and keep margins built up.

The problem is by no means solved by referring to the four C's of commercial credit. It is merely defined. The classification enables us to think more clearly and with a proper balance, unconfused by the complexity of the subject. The technique of evaluating character, capacity, capital and collateral must be elaborated in a more comprehensive way than an interview will permit. Let me illustrate, however, the method of approach. Capital is variously listed depending both on the type of organization and the attitude of the author of the financial statements. A banker must analyze the statement with both those things in mind. Some firms will capitalize intangible assets such as good will, patents, trademarks and the like; some business houses write down the values of fixed assets such as land, buildings and machinery in a conservative way that will be desirable. In some corporations common stock represents real value, in others it will be tucked in to make resources and liabilities match. These are but a few of the questions to be answered on this one point.

Again, a proposition must be in bankable shape to receive commercial credit. This means among other things that the quick or liquid assets, which include cash on hand or on deposit, bills and accounts receivable and merchandise, should be approximately twice as great as the quick liabilities. This so-called 2 to 1 ratio is perhaps the most widely recognized and practiced generalization in commercial loaning by banks. Naturally it is not rigid and during the war period and days of readjustment it had to be abandoned. Honest customers operating largely upon government orders had to be aided regardless of the ratio of their assets and liabilities. Then, as in the past, banks had need to violate conservative practices. Thus it is that the commercial banker works. He must be a constructionist aiding worthy enterprises with his every resource. For so he will prosper as an integral part of the community.

Mineral Production in Ontario

Abstract of an Address by Canadian Bureau of Mines Head, With Particular Emphasis on Nickel and Iron

While addressing the Engineering Institute of Canada in Ottawa recently, John McLeish, director of the Department of Mines, Canada, stated that a very large proportion of the important minerals of commercial value in Canada are to be found in the Province of Ontario. The nickel deposits at Sudbury supply over 80 per cent of the world's demand. They also possess very large ore resources and are at present sufficiently developed to maintain the present industry for more than 100 years. Favorable results have already been obtained in the demonstration of new uses for nickel. The question at present under consideration is the development of a market to replace that which armor plate formerly provided.

The total value of mineral production in Ontario increased from approximately 15 millions in 1902 to more than 25 millions in 1906, and in 1913 amounted to nearly 60 millions. Through increased production and high prices, a value of 95 millions was reached in 1918, or approximately 45 per cent of the total value of the production for all Canada. In 1919, the first year following the war, production dropped to 68 millions, rose the next year to nearly 82 millions, dropped in 1921 to 54 millions and is again on the up grade, having reached about 65 millions in 1922.

Turning to the iron situation, Ontario has not, as yet, been able to develop a successful and continuous ore industry. Ores of merchantable grade in the natural state have not been available in large quantities. There are, nevertheless, large resources in low-grade ores, principally magnetite and siderite, which should be put into commercial form. The most serious attempts have been on the siderite ores at Magpie and the magnetites at Sellwood, north of Sudbury. Both of these have been successful in producing an excellent furnace product, but the cost is still too high to justify continued commercial operations.

Constancy of Platinum Thermocouples

Life tests of the pure platinum and platinum-rhodium wire prepared at the Bureau of Standards for thermo-couples have been carried out by the heat division. These tests are the same as those applied to commercial couples which were recently reported by Fairchild and Schmitt in *Chem. & Met.*, Jan. 25, 1922 (vol. 26, p. 158). Results thus far obtained indicate that couples of material purified, melted, and drawn to wire at the bureau are appreciably superior to the best commercial couples previously tested.

Industrial Importance of the Metallic Soaps

Striking Properties of These Relatively Unfamiliar Substances Indicate a Wide Range of Commercial Applications

By Hilton Ira Jones

Director of Research, Redpath Bureau, Redpath Laboratories, Wilmette, Ill.

Author's Note: This work was originally begun in 1910 in connection with a problem for the American Kellystone Co. on the waterproofing of its products. It was again resumed in 1918 in connection with the work of Robert DuBois for his Master's degree. It was at this time directed toward the preservation of eggs (see *Journal of Industrial and Engineering Chemistry*, August, 1920). It was continued during 1919-1921 as a part of the work of Gladys Trevithick for her Master of Science degree. During the past year it has been carried further as a part of our work on the waterproofing and mildew-proofing of canvas for the Redpath Bureau.

METALLIC soaps, as the term is used in this article, refer to the stearic, palmitic, oleic and hydrogenated-oil soaps of magnesium, copper, aluminum, zinc, lead, nickel, calcium, cadmium, antimony, strontium, tin, cobalt, barium, iron (ferrous and ferric), silver, mercury (-ous and -ic), arsenic, chromium, bismuth, magnesium, ammonium and lithium, all of which have been prepared and systematically studied. The water-soluble soaps of the alkali metals are not included in this classification.

Although these materials are not familiar articles of commerce, they are nevertheless important products from an industrial viewpoint. Their actual as well as potential uses cover a wide range of industries. They find a large market in the manufacture of lubricating greases. Another important use is in paint and varnish as driers. One of the greatest present and potential uses of the metallic soaps is in the waterproofing of cloth. Minor uses are found in disinfectants, in medicine, in taxidermy and in dry cleaning. More detailed reference to the industrial applications of the metallic soaps will be found elsewhere in this article.

Preparation on the Cloth

Most metallic soaps, because of their great insolubility in water, are prepared by precipitation. A warm water solution of the alkali soap of the desired acid is added to a water solution of the salt of the desired metal, and the precipitate of the metallic soap is pressed dry and later dissolved; or else the material to be waterproofed is impregnated first with the one solution and then the other, thus precipitating the metallic soap within the pores of the object. One of the large tent companies formerly treated all its canvas in this way. This is a less efficient and desirable method for reasons presently to be shown. Often the aluminum soaps are precipitated within the fiber of cloth, especially canvas, by an electrolytic process. In this process the cloth is passed through a warm bath of the soap, squeezed out between pinch rolls, and passed directly into the "electric bath," where it runs between aluminum electrodes. The precipitating aluminum hydroxide combines with the soap in the cloth, thus precipitating the aluminum soap in the fiber.

Metallic Soap "Solutions"

While we speak of a soap's "solubility," it is doubtful if any soap ever forms a true solution. The solutions are apparently in all cases colloidal emulsions. The alkali soaps, however, form with water what generally pass for true solutions. The presence of many oils, such as kerosene, gasoline, paraffine and the like, often even in very small amounts, produces a great increase in the fineness of the colloidal aggregate. This fact explains, of course, the added cleaning and detergent power possessed by soap in case some of these oils are added—hence the "naphtha soaps" and the score of washing compounds, which are mainly paraffine plus, say, a little ultramarine. The surface tension is also raised as the colloidal aggregate becomes finer. Indeed, the colloidal dispersion and the surface tension bear, it seems, a definite relation to each other.

Most dry metallic soaps—for example, aluminum stearate—are as insoluble in gasoline, alcohol, chloroform and the like as they are in water. The freshly prepared wet soap is readily soluble. If once the soap is dried, the colloidality is destroyed and water cannot easily again be incorporated with it. The solution in the other paraffine oils works the same as gasoline. It is remarkable the amount of water these oil emulsions of the metallic soaps will "take up." They are much like lanolin in this respect. This solution of the metallic soaps has always presented difficulties. Often "smooth" solutions will be obtained, and then again they will settle out. In fact, the published directions for using such commercial solutions as are on the market seem to take it for granted they will be colloidal failures and settle. So they admonish the consumer to "shake or stir thoroughly." The making of solutions of metallic soaps is the old problem of mayonnaise dressing. The trick is to get the true colloidal state, and the second is to keep it so. The temperature of the precipitation seems to be an important factor. Below a certain critical temperature, for example, copper stearate comes down as a non-colloidal granular mass. But when freshly precipitated from a hot solution above this critical temperature (as it should be), it is tremendously sticky, and reminds one of chewing gum. Cold, it is a hard, brittle wax, similar to molasses candy. This wax is readily soluble in gasoline and other paraffine oils to form a mucilaginous, colloidal solution, which can be kept indefinitely without settling. Many substances, of course, like acids, and conditions, like freezing, will break the colloid and make the soap settle out. In the formation of such a solution, the water is as essential as the oil.

Stabilizing Effect of Added Wax

It has been found that the addition of colloid waxes, such as lanolin or beeswax, has a remarkable stabilizing effect on the colloid. Such solutions may be evaporated and the wax heated to 45 deg. C. for weeks without the colloid being in any way affected. Pure sugars crystallize readily from pure solvents. A mixture of sugars crystallizes with difficulty, especially if impure. So a mixture of colloids is more stable than a single pure one. This fact is of the greatest importance, since the usefulness of the metallic soaps depends largely upon their being maintained in colloidal condition.

The pure metallic palmitates and stearates are almost impossible to maintain as colloids without the addition of one of these waxes. This fact explains why their use has been so often disappointing. On the other hand, the oleates are generally so soft as to render the finished product, say canvas, sticky and they also tend to turn rancid with age. We have found that the use of hydrogenated-oil soaps seems to solve both difficulties. There seems to be no single hydrocarbon solvent in which the dry metallic soaps are soluble. They are all soluble when

wet and freshly prepared by precipitation. But the best solvents vary with the metal and the acid. Commercial lead soap with linoleic acid goes into solution easily in almost all hot petroleum solvents and comes out again from the cooled solvent almost completely within an hour. The nickel soaps separate out in several days. The ferrous iron soaps go into solution easily and come out again in a few hours increased in weight (due to oxidation). The ferric soaps are much more insoluble. Wet aluminum soaps are soluble in gasoline, turpentine and benzene. The oleates of calcium, magnesium and iron dissolve readily in glycerine. The ammonium soaps are all very soluble in water. Lead, magnesium and copper soaps, if wet, are soluble in alcohol and ether. Zinc oleate is soluble in carbon bisulphide, etc.

The literature on the solubility of the numerous metallic soaps is chaotic and unreliable because the colloidal character and the part played by the water and other factors have not been recognized. For example, one author states that "aluminum soap is very insoluble in nearly all solvents." This is true only if it has been allowed to dry. The wet freshly prepared soap is readily soluble in several solvents. The addition of a little colloidal wax, as lanolin, will completely alter the solubility. The whole matter of preparing these colloidal emulsions of the metallic soaps is complex and not well understood.

Colloidal Properties

The same chaotic state seems even more pronounced when we examine the literature relative to the properties of these metallic soap solutions. This is probably because their colloidal character has not always been recognized. Moreover, the characteristics of such colloids have been little known, but much has been surmised. Their properties are due, it seems, somehow to the extreme fineness of the particles in suspension. These conditions vary within wide limitations, but in a general way this condition apparently begins with dimensions somewhat smaller than the wave length of light and extends downward well into such dimensions as theory ascribes to the molecules of crystalloids. Such solutions are micro-heterogeneous systems distinguished from true solutions of molecules or ions by the possession of surfaces of contact with all the properties implied by this. These properties will naturally be very marked because of the enormous surface provided by the minute state of subdivision. These enormous surfaces provided enable such colloids to adsorb in the interface a great variety of substances and these often in surprising amount. Always the substance used to produce this dispersion, which for lack of a better term Graham called a "peptizing agent," will be most adsorbed. This in the case of these metallic soaps is nearly always water. This explains the unusual waterproofing character of these soap colloids and makes plain why they must be maintained on the fiber in colloidal state. As the soap-impregnated fiber is wetted a swelling takes place—exactly analogous to the swelling of gelatine in water, and the pores of the fiber are absolutely sealed. Extremes of heat and dry air, and especially high concentrations of the violet and ultra-violet light rays, such as we get in New Mexico and Arizona, for example, all tend to destroy the colloidal properties of the soaps in the canvas, which then gradually dust out and are carried away by the continual beating of the wind. Thus the metallic soaps precipitated directly on the fiber, as in the double dip or "electric process," are soon lost and made valueless. Those prepared with the addition of colloidal waxes as mentioned are more stable.

These colloids will also take up all manner of perfumes, essential oils, dyes and pigments, and in fact anything soluble either in the water or the oil. They will adsorb many things soluble in neither, especially if the material is colloidal. They form, consequently, an ideal vehicle for medicinal salves, plasters and ointments. These facts might well lead to several valuable changes in the present pharmacopea—e.g., the substitution of colloidal zinc soap for the ordinary powdered zinc stearate. Their tremendous surface tension makes them great detergents. They will be incorporated as a part of many soaps when these facts are realized. Sufficient sodium tungstate may be incorporated with these metallic soap colloids so that the canvas is fireproof as well as waterproof.

The efficacy of many drugs and poisons appears to depend upon the fineness of the subdivision—that is, the exposed surface area. This suggests the use of these colloidal metallic soaps in all manner of sprays, in fungicides—e.g., copper soaps—medicines, as colloidal mercury and the like. We have found that extraordinarily small amounts of colloidal copper soap will produce unexpected protective effects against mildew and the like.

These striking effects of the metallic soaps that lend them so well to a multitude of uses provide their own undoing in one case. There are certain colloidal clays, like the Denver mud and fullers earth, as is used in petroleum refining, which have, as is well known, great adsorbing powers, especially for colloidal substances which they thus tend to remove from the more crystalloidal (less colloidal) sugars, oils, etc. When a metallic soap-protected canvas is unrolled and rolled up again on a wet clayey ground, the clay is obviously pressed into the very fiber of the canvas and there it adsorbs the colloidal soap and entirely removes it from the cloth. The very properties which make the soap valuable as a waterproofing and mildew-proofing substance facilitate its removal by the clay. No method of preventing this action of these clays has come to light.

As we can obtain supersaturated solutions of crystalloids and small additions of certain substances tend to increase this possible supersaturation disproportionally, so there appears to be no definite solubility in respect to colloidal suspensions. The finer the state of subdivision the more will dissolve, the more stable the colloid will be and the greater will be the surface tension, as well as the detergent and adsorbing power. Such stabilizers are now generally called "protective colloids," because they protect the colloidal particles from separating out. They are themselves generally colloidal.

Industrial Applications

Lubricating Greases. The properties of these various metallic soaps have already caused them to be put to a great number of practical uses. The use in greases is one of the best known. The greases on the market may be divided into four main groups:

1. Greases with alkali soaps used as hardeners.
2. Greases made with fatty oil and lime soaps.
3. Greases with both alkali and lime soap.
4. Greases made with rosin oil and lime soaps.

These vary greatly in composition and kind. They contain anywhere from 5 to 50 per cent of soap and by varying the proportions of soap and filler, greases of any desired consistency can be made. Zinc, aluminum, magnesium and lead soaps are also used in greases and lubricating oils. Lead soaps are especially used in a class of lubricants known as "anti-friction greases." Lead soaps are hard at low temperatures, viscous at ordinary temperatures, but sufficiently fluid under the heat of friction.

Paint and Varnish Driers. Another great present-day use of metallic soaps is in paints and varnishes as driers. Lead and manganese oleates are mostly used. The former is made by saponifying litharge with olive or cottonseed oil; the latter by the direct action of manganese carbonate on oleic acid. The enormous surface obtained by using these colloidal soaps of the metals explains their effectiveness. In case high temperatures are used in hastening the oxidations, the varnishes are spoken of as baking japans. The ordinary linoleates, and resinates of lead and manganese, which form the basis of so-called driers, act by catalysis causing a rapid oxidation of the oil or varnish to which they are added. Lead and manganese form both a lower and a higher oxide which readily pass from one to the other. When present in the film in the higher state of oxidation they give up half their oxygen to the oil, then take up more from the air and so act continuously as catalytic agents to pass along oxygen from air to oil. In this the manganese soaps are more active than the lead. Other metallic soaps such as nickel and cobalt, which readily change from one state of oxidation to another, may be used in these driers, but they appear to have no advantage over the lead and manganese compounds. It is remarkable the catalytic effect produced by minute traces of these metallic colloids. With less than one-tenth of 1 per cent, the effects are very marked. The greatest danger is the use of too much, since it is likely to continue to act slowly even after the film has hardened and so in time to destroy the strength and elasticity. Such driers are generally not used in spirit varnishes nor baking japans.

Waterproofing. The waterproofing of objects by means of the metallic soaps furnishes one of its greatest present and potential uses. The use in waterproofing of cloth has already been mentioned. Our process for sealing eggs with colloidal solutions of aluminum soap has already been published. We are now working on similar processes for preserving fruits and vegetables. Most attempts at waterproofing cements and the like have depended upon the direct precipitation. This has generally resulted unsatisfactorily because of the tendency of the precipitate to lose its colloidal character. This is especially noticeable in case of the aluminum soaps precipitated in concrete, and the magnesium oxychloride cements. We have found that the use of protective colloids tends to prevent this loss of colloidality. By similar solutions coupled with protective colloids we have obtained excellent results in the weatherproofing and rustproofing of iron. Such solutions form an ideal vehicle for aluminum and bronze powders and also various oxides.

Medicines. Dzevagoviskii and Stepanova[1] have studied the disinfecting power of naphthalic acid, cresolated and formaldehyde soaps. We have found that the germicidal power of such soaps is much surpassed by the incorporation into ordinary soap of colloidal mercury oleate. These colloidal organic compounds of mercury are much to be preferred to inorganic mercurials, as they are not injurious to the skin. Similar colloidal copper soaps have unexpected fungicidal properties. Vermorel and Dantory[2] have written of these.

Most metallic soaps will dissolve in both the alcohol (glycerine) or the fatty acid. Such solutions of the calcium and iron soaps are valuable in medicine for lime insufficiency, especially in the case of nursing mothers and in anemics. They would be more widely used if the value of colloidal drugs were generally realized.

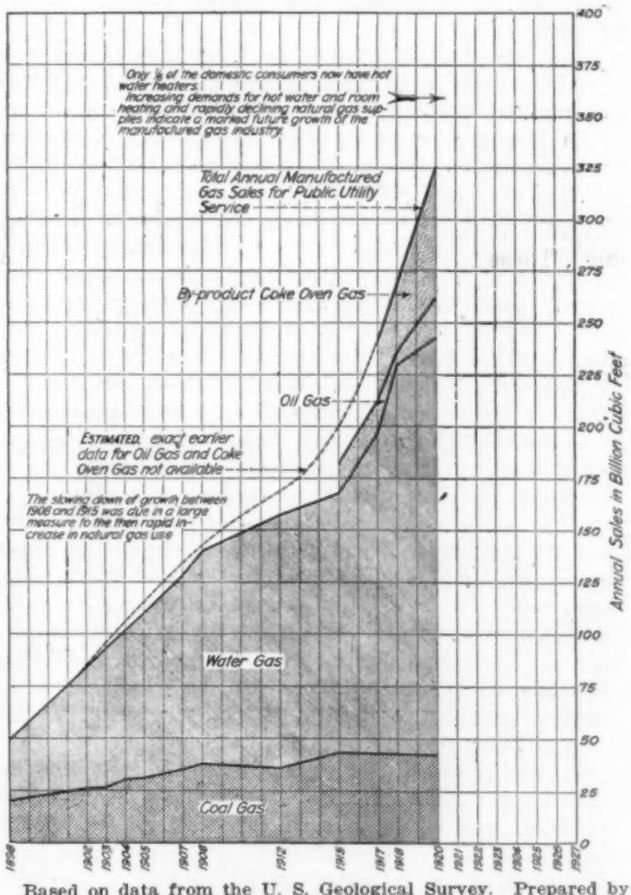
Miscellaneous. In laundering the formation in the fabric of insoluble soap precipitates, especially of iron, causes a marked deterioration in the strength of the cloth.

Arsenite soaps containing camphor have long been used by taxidermists in preserving the skins of birds and animals. It would seem that such colloidal soap solutions would be much more effective as sprays in fighting the boll weevil, for example, than the arsenates now employed. In general, colloidal solutions should be more effective than physical suspensions, just in proportion as the exposed surface is greater.

For long the dry cleaners have been using "benzine soaps" in their gasoline for dry cleaning. After each time used, or at most a few times used, the gasoline is run through centrifugals to remove the water and suspended matter. In time, however, the gasoline becomes highly colored and has a very disagreeable odor. This is due to the accumulation of unknown sulphur compounds from the perspiration in the garments. This accumulation is possible because of the adsorbing power of these benzine soaps. Of course the cleaning value is due to this same adsorbtion. The substitution of lead hydrogenated oil soaps should increase the surface tension and adsorbing power more than the benzine soaps used at present, and in addition would take care of the troublesome sulphur compounds by precipitating them as fast as encountered. Further work on this is now being carried out.

[1] *Arch. Sci. Biol.*, vol. 14, pp. 283-303.
[2] *Compt. rend.*, vol. 152, pp. 1263-5.

Growth of Manufactured Gas Sales for Public Utility Service in the U. S.



Based on data from the U. S. Geological Survey. Prepared by Samuel S. Wyer, Consulting Engineer, Columbus, Ohio.

Modern Methods for Making Cupola Mixtures

Diagrams Are Useful to Determine Amounts of Available Pig Iron to Weigh Into Mixture in Order to Secure Castings of Required Composition — Silicon and Manganese May Both Be Easily Predetermined if Three Piles of Pig Iron Are in the Yard

BY H. L. CAMPBELL
Assistant Professor of Metallurgical Engineering,
University of Michigan

OF the many factors which contribute to the economic production of iron castings, one of the most important is the proper proportioning of the metal mixtures used in the foundry. As the prices of raw metals are based largely on their compositions, it is imperative that the most economical mixtures of metals be used. The price of pig iron is dependent upon the elementary constituents in the metal. As the silicon and manganese contents increase or the sulphur and phosphorus contents decrease, the price advances. Likewise, scrap metals are sorted into groups according to the previous uses of the metal parts; which is indirectly a classification based on the composition of the metals. The cost of any ferro-alloy is determined on the basis of its important elementary constituents. Since these materials are purchased as chemical compounds, their true values will be obtained only when they are used as chemical compounds and mixed so as to produce the desired analysis in the product.

It is recorded by Thomas D. West that previous to 1890 practically all of the foundries in the United States had purchased pig iron on the basis of the appearance of the fractured surfaces of the metal. The metal with the most open grain structure was used for the softest castings and the close-grained iron was melted for hard castings. The practice of using the "fracture grading" method in preparing cupola charges led to many foundry troubles and unreliable properties in the castings. The foundry industry has been slow in adopting the practice of mixing metals by analysis and even today there are foundries where little attention is given to proportioning the metal mixtures used in cupola charges.

One of the important demands on iron castings today is uniformity in hardness. This requirement has resulted from the modern practice of rapid production in the machine shop. Machine tools are equipped for multiple operations and if castings of non-uniform hardness are machined, the adjustments of the tools will not remain fixed and a delay in production and inaccuracies will result. It is not uncommon to find an industry paying a premium for castings with uniform machinability. This condition may be obtained by controlling definitely the metal mixtures for the cupola so as to obtain a uniform composition which will result in uniform physical properties in the castings.

As the physical properties of the metals are dependent upon their chemical compositions, definite compositions may be established for castings for specific uses. The service requirements of gears, grate bars, stove plate, steam cylinders, car wheels and sash weights are entirely different and therefore the analysis of the metal used in each of these types of castings should be different. The limits or range of composition of the castings to be produced must be established first. Then the proportions of scrap metals and pig iron for the metal charges must be determined.

THE USE OF SCRAP METALS

The results of experience and a knowledge of the compositions produced after melting will enable a foundryman to decide upon the pig iron and scrap proportions suitable for a given type of castings. The relative amounts of pig iron and scrap which will produce solid castings that will pass rigid inspection should be used. From 0 to 100 per cent scrap iron may be used in the metal charges for the cupola. Castings produced from all-scrap mixtures are generally hard and of inferior quality. The average practice is to use from 40 to 60 per cent of selected iron scrap in the metal charges.

In every foundry a certain proportion of the metal poured is returned to the cupola to be remelted in later charges. This scrap, which is sometimes called "home scrap" or "returned foundry scrap," consists of defective castings and sprues from previous heats. The amount of this scrap varies from 25 to 50 per cent of the total metal poured.

In addition to the returned foundry scrap, it is generally necessary to purchase some iron scrap from outside sources. Also, it may be desired to use some steel scrap in the charges for certain types of castings. There is an advantage in obtaining uniform grades of purchased scrap. The composition of the returned foundry scrap will be approximately the same as the castings produced. It is necessary to estimate or actually determine the average analysis of the purchased iron and steel scrap. This information is required when figuring the metal charges.

CHANGES IN COMPOSITION DUE TO MELTING IN CUPOLA

Before the amounts of the components in a metal charge can be computed it is necessary to determine the effect of the melting process on the elements in the metal charges. The change in composition of the metal mixture before and after melting will depend largely upon the practice of melting; and for a given installation and a definite practice this variation in composition will remain the same for all heats. By using mixtures of known composition and analyzing the resulting cast metal, the effect of cupola melting on the elements in the charges may be established.

Silicon is partly oxidized in the cupola and the loss is about 10 per cent of the silicon in the metal mixture. Therefore an excess of silicon will be required in the metal charged over the amount specified in the castings.

The manganese content of the metal mixture is also decreased during the melting of the metal in the cupola. A manganese loss of 15 per cent of the original manganese content is generally assumed.

The sulphur content of the metal is increased upon remelting, as the metal takes up sulphur from the fuel. The metal gains in sulphur about 0.02 per cent when melted with coke containing less than 0.75 per cent sulphur.

The action of the remelting process as related to phosphorus is mainly that of concentration, although coke contains about 0.01 per cent phosphorus, which may be dissolved in part by the metal. Phosphorus and sulphur are not oxidized during the melting process, but may be removed from the metal to some extent by the slag. If the average phosphorus content of the metal mixture is below 0.80 per cent, an increase of 0.02 per cent phosphorus in the metal may be used in computing metal mixtures. While it is possible to assume certain changes in the elementary content of the metal charges during melting, it is better practice to determine these factors experimentally for a given cupola practice.

The raw metals are generally procured within the maximum limits of the sulphur and phosphorus requirements of the castings produced. The desired manganese content may be obtained by proportioning the metal charges or by the addition of manganese to the molten metal. The pronounced influence of silicon on the properties of cast iron warrants the practice of using this element as the determining factor in calculating metal mixtures.

After establishing the analysis of the castings, the scrap proportion and the changes incurred in melting, it is possible to determine the exact amounts of the components in each metal charge. In order to illustrate specific methods for making metal mixtures, some hypothetical compositions are used.

The desired analysis of castings and the compositions of pig iron and scrap metals available are given in Table I.

As 10 per cent of the silicon in the total metal mixture is lost in melting, the average silicon required in the metal mixture is found by dividing 1.80 per cent by 0.90 (1.00 minus 0.10), which gives 2.00 per cent silicon in the metals charged into the cupola. The average manganese content of the total metal mixture is obtained by dividing 0.70 per cent by 0.85. The sulphur and phosphorus increase during the melting process, but not in direct proportion to the amounts of these elements in the raw metals. Sulphur increases 0.02 per cent. Therefore the average sulphur content of the total metal mixture is found by subtracting 0.02 per cent from the maximum sulphur content of the castings. The percentage of phosphorus is arrived at by subtracting 0.02 per cent from 0.50 per cent.

A proportion of 50 per cent pig iron and 50 per cent scrap iron is assumed in the charges figured here by way of illustration. Of the total scrap, three-fifths is returned foundry scrap (30 per cent of total mixture), which will have approximately the same analysis as the castings, and two-fifths is purchased scrap (20 per cent of total mixture), which consists of machinery castings. The average analysis of the scrap is found by adding three-fifths of the foundry scrap analysis to two-fifths of purchased scrap analysis.

The average composition of the pig iron mixture may be found by multiplying the average composition of the scrap by its percentage, subtracting this product from 100 times the composition of the total metal mixture charged and then dividing by the percentage of the pig iron used.

$$\frac{(100 \times 2.00) - (1.74 \times 50)}{50} = 2.26 \text{ per cent silicon in pig iron mixture.}$$

$$\frac{(100 \times 0.82) - (0.70 \times 50)}{50} = 0.94 \text{ per cent manganese in pig iron mixture.}$$

As the combined pig iron mixture must average 2.26 per cent silicon, it will be necessary to mix two lots of pig iron with silicon contents above and below this amount. If piles *A* and *B* are used, it will be necessary to find the exact amount of metal from each of these piles for one metal charge. The pig iron mixture may be determined by the use of algebra or the application of a simple formula or by a graphical method.

Let M = pounds of metal in one charge.
Let X = pounds of metal from pile *A*.
Then $(M - X)$ = pounds of metal from pile *B*.
The total silicon in the mixture equals the sum of silicon from piles *A* and *B*.

$$(M \times 2.26) = (X \times 2.83) + (M - X) \times 1.34$$
$$2.26M = 2.83X \times 1.34M - 1.34X$$
$$0.92M = 1.49X$$
$$\frac{0.92M}{1.49} = X = 0.62M \text{ lb. of metal from pile A.}$$

and $$\frac{0.57M}{1.49} = 0.38M \text{ lb. of metal from pile } B.$$

By the method given above, the proportions of the two piles of pig iron which will produce the exact silicon content in the mixture will be derived. The manganese, sulphur and phosphorus contents of the mixture may be obtained by multiplying the proportions of the two piles of pig iron by the amounts of their elementary constituents.

The Use of Formulas in Making Metal Mixtures

$(0.62 \times 0.96) + (0.38 \times 0.98) = 0.97$ per cent manganese in mixture.

$(0.62 \times 0.04) + (0.38 \times 0.03) = 0.036$ per cent sulphur in mixture.

$(0.62 \times 0.40) + (0.38 \times 0.38) = 0.39$ per cent phosphorus in mixture.

The proportions of metal from two piles of pig iron which will give the desired silicon content in the mixture may be derived by the use of formulas.

Let L = per cent silicon in low-silicon pig iron.
Let H = per cent silicon in high-silicon pig iron.
Let D = per cent silicon desired.

If piles *A* and *B* are used, then according to the equations derived in the previous algebraic problem:

$$\frac{D - L}{H - L} = \frac{2.26 - 1.34}{2.83 - 1.34} = \frac{0.92}{1.49} = 62 \text{ per cent} = \text{ratio of metal in one charge from high silicon pig iron, pile } A.$$

$$\frac{H - D}{H - L} = \frac{2.83 - 2.26}{2.83 - 1.34} = \frac{0.57}{1.49} = 38 \text{ per cent} = \text{ratio of metal in one charge from low silicon pig iron, pile } B.$$

Graphical Methods for Determining Metal Mixtures

A graphical method for determining the proportions of high- and low-silicon pig iron in a mixture having a desired silicon content may be applied as follows: Use piles *A* and *B* with the analysis of the pig iron mixture as given in Table I. Refer to Fig. 1 for graphical solution.

First, lay off in any convenient scale, on a base line, the amount of percentage of metal in one charge.

TABLE I

	Silicon, Per Cent	Manganese, Per Cent	Sulphur, Per Cent	Phosphorus, Per Cent
Desired analysis of castings	1.80	0.70	0.08	0.50
Changes in composition	—0.20	—0.12	+0.02	+0.02
Composition of total metal mixture charged	2.00	0.82	0.06	0.48
Pig iron—pile *A*	2.83	0.96	0.04	0.40
Pig iron—pile *B*	1.34	0.98	0.03	0.38
Pig iron—pile *C*	2.00	0.80	0.04	0.43
Returned foundry scrap (30 per cent of mix used)	1.80	0.70	0.08	0.50
Purchased scrap (20 per cent of mix used)	1.65	0.70	0.08	0.45
Average analysis of scrap (50 per cent of mix used)	1.74	0.70	0.08	0.48
Composition of pig iron mixture (50 per cent of mix used)	2.25	0.94	0.04	0.48

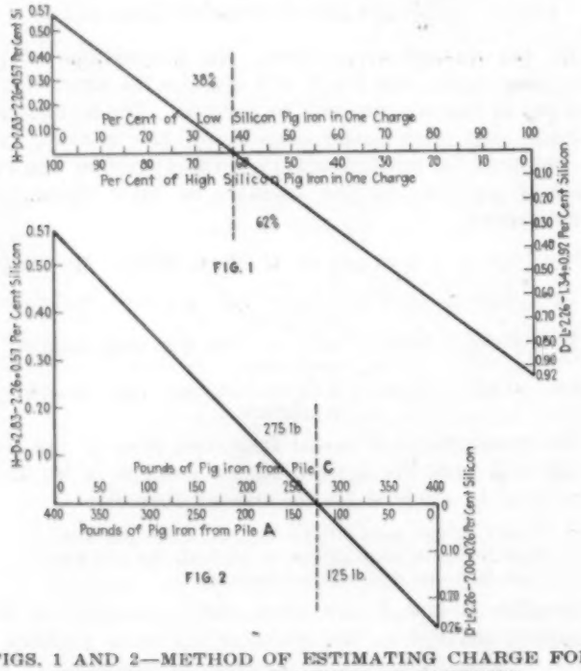
Second, find the difference in the high and desired percentages of silicon in the metal.

Third, plot this difference in any convenient scale, at right angles to one end of the base line.

Fourth, find the difference in the desired and low percentages of silicon in the metal.

Fifth, plot this difference in the same scale as was previously used, at the other end of the base line and in the opposite direction.

Sixth, connect the extremities of the graph by a straight line. The point of intersection will then divide the base line into two parts corresponding to the proportions of high- and low-silicon pig iron in the mixture.


38%
Per Cent of Low Silicon Pig Iron in One Charge
Per Cent of High Silicon Pig Iron in One Charge
62%
FIG. 1
275 lb.
Pounds of Pig Iron from Pile C
Pounds of Pig Iron from Pile A
125 lb.
FIG. 2

FIGS. 1 AND 2—METHOD OF ESTIMATING CHARGE FOR DESIRED SILICON CONTENT IN CASTINGS

The portion of the total mixture lying adjacent to the *H-D* line represents the amount of metal with a low content of the special element. The portion of the base line lying adjacent to the *D-L* line represents the amount of metal with a high content of the special element.

To illustrate the graphical method by another example: suppose it is desired to mix piles *A* and *C* to obtain 2.26 per cent silicon in the pig iron mixture containing 400 lb. of metal. The solution is given in Fig. 2.

To Obtain Exact Quantities of Two Elements in a Mixture

In the previous problems the amount of pig iron from each of the two piles was found which would give a definite content of one element, silicon, in the final castings. A pig iron mixture may be proportioned to give definitely two elements in the resulting product, providing there are available at least three piles of pig iron with analyses within a limiting range. It is rarely desired to control more than two elements in a metal mixture for cast iron.

In order to determine whether it is possible to obtain the required silicon and manganese contents from three

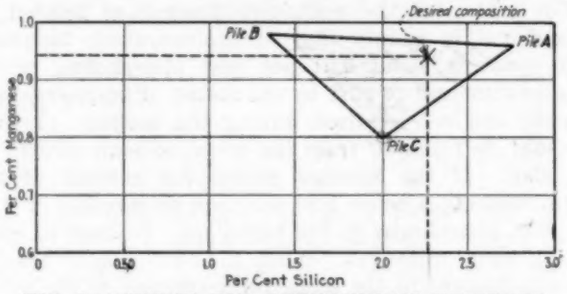


FIG. 3—SCHEME FOR DETERMINING WHETHER AVAILABLE PIG IRON SUPPLIES WILL FURNISH THE DESIRED COMPOSITION

piles of pig iron containing different amounts of these elements, a chart is prepared with two ordinates at right angles on which increasing amounts of silicon and manganese are laid off from the origin. The three points corresponding to the compositions of the three piles of metal are plotted on the chart and connected with straight lines. If the locus of the point representing the required silicon and manganese falls within the triangle, it is possible to mix the three piles of pig iron to obtain the exact silicon and manganese required. All combinations of silicon and manganese represented by points lying outside of the triangle cannot be produced exactly from the three compositions available.

On Fig. 3 the points corresponding to the compositions of the three piles of pig iron given in Table I are plotted. Also, the point corresponding to the desired silicon and manganese in the pig iron mixture is shown. As this point lies within the area of the triangle, it is possible to obtain the desired silicon and manganese in a mixture of the three piles of pig iron. The amount of metal from each of the piles may be determined as follows:

Let M = lb. of metal in total pig iron mixture.
Let X = lb. of metal from pile *A*.
Let Y = lb. of metal from pile *B*.
Then $M - X - Y$ = lb. of metal from pile *C*.

First, balance the equation for silicon

$$2.83X + 1.34Y + 2.00\ (M - X - Y) = 2.26M$$
$$2.83X + 1.34Y + 2.00M - 2.00X - 2.00Y = 2.26M$$
$$0.83X - 0.66Y = 0.26M$$

Second, balance the equation for manganese

$$0.96X + 0.98Y + 0.80\ (M - X - Y) = 0.94M$$
$$0.96X + 0.98Y + 0.80M - 0.80X - 0.80Y = 0.94M$$
$$0.16X + 0.18Y = 0.14M$$

Third, solve for X and Y

$X = 0.55M$ lb. of pig iron from pile *A*.
$Y = 0.29M$ lb. of pig iron from pile *B*.
$M - X - Y = 0.16M$ lb. of pig iron from pile *C*.

Manganese May Be Increased by Ladle Additions

If there is not a sufficient range of composition of pig iron on hand to allow the control of both silicon and manganese in the mixture, or if the manganese is too low in the pig iron available, the manganese content of the metal may be increased by the addition of ferromanganese to each ladle of molten metal. For this purpose, ferromanganese containing 80 per cent manganese is generally used. About one-half of the

manganese added in the ladle is lost by oxidation or in the slag. As the melting point (2,210 deg. F.) of this alloy is close to the melting point of cast iron, the ferromanganese should be crushed, preheated and stirred well into the molten metal.

The task of computing metal mixtures in the foundry may be neglected, unless some simple means is provided for arriving at the correct mixtures. To facilitate the rapid and accurate determination of the charges for cast iron, charts may be prepared from which the relative quantities of the different metals making up the charges may be read directly.

The curves in Fig. 4 have been plotted to obtain directly all possible combinations of any piles of pig iron which will have an average silicon content of 2.10 per cent. Using this figure as the origin, decreasing percentages of silicon are laid off on the base line toward the right. On the left side of the chart are arranged, in columns, the scrap and pig for every possible mixture. Each lot of high-silicon pig is represented by a curve. In order to find the correct mixture of any two cars of pig iron which will produce the desired composition in the castings, a line is drawn

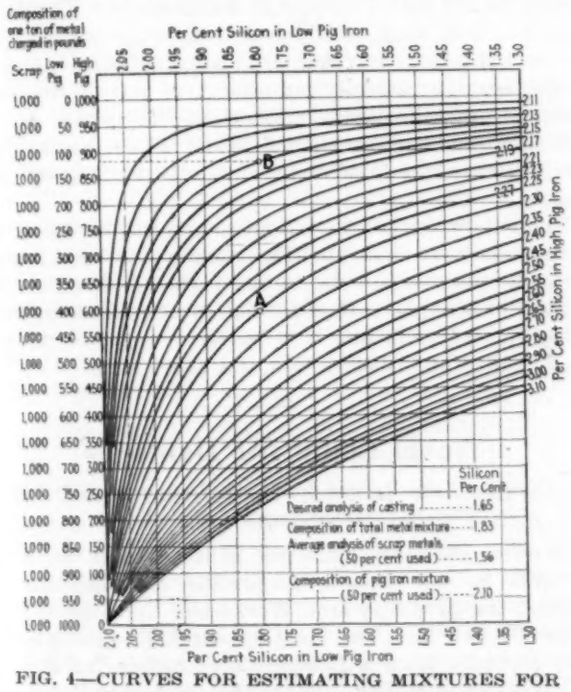

Composition of one ton of metal charged in pounds
Per Cent Silicon in Low Pig Iron
Scrap
Low Pig
High Pig
Per Cent Silicon in High Pig Iron
A
B
Silicon Per Cent
Desired analysis of casting 1.65
Composition of total metal mixture 1.83
Average analysis of scrap metals (50 per cent used) 1.56
Composition of pig iron mixture (50 per cent used) 2.10
Per Cent Silicon in Low Pig Iron

FIG. 4—CURVES FOR ESTIMATING MIXTURES FOR 2.10 PER CENT SILICON CASTINGS

vertically from a point on the base line which corresponds to the silicon in the low-silicon pig to the intersection of the curve which represents the per cent silicon in the high-silicon pig iron; and from this point of intersection a horizontal line is drawn to the left which will indicate the proper weights of scrap, low-pig and high-pig for each charge.

If it is desired to use three or more lots of pig iron to a charge, the mix for any two lots must be found first and then any proportion of the different mixes may be added up to give the full charge.

As an example: Suppose the scrap metals average 1.56 per cent in silicon and there are two cars of pig iron on hand containing 1.80 per cent and 2.30 per cent silicon. Point *A* in Fig. 4 is the intersection of the two curves and the horizontal line through this point indicates that a full charge will consist of 1,000 lb. of scrap, 400 lb. of low-silicon (1.80 per cent) pig iron and 600 lb. of high-silicon (2.30 per cent) pig iron. If in addition to the two cars of pig iron there is in the foundry yard a small pile of 440 lb. of pig iron containing 2.14 per cent in silicon, then the correct charge may be found as follows: It is shown on the chart (point *B*) that 120 lb. of low-silicon (1.80 per cent) pig iron must be mixed with 880 lb. of high-silicon (2.14 per cent) pig iron or that one-half of this mixture will use up all of the 2.14 per cent silicon pig iron. Therefore one-half of this mixture must be added to one-half of the mixture from the two cars in order to give the total charge, which will consist of 1,000 lb. of scrap, 260 lb. of 1.80 per cent silicon pig iron from car, 300 lb. of 2.30 per cent silicon pig iron from car and 440 lb. of pig iron from yard.

In the preparation of similar charts it is first necessary to determine the silicon content of the pig mixture, the total charge and the proportion of scrap to be used. When these values are established, the curve for each high-silicon pig iron may be plotted.

m = lb. of pig iron in one charge.
x = lb. of low-silicon pig in one charge.
$(m - x)$ = lb. of high-silicon pig in one charge.
q = per cent silicon in low-silicon pig iron.
r = per cent silicon in high-silicon pig iron.
s = per cent silicon in pig iron mixtures.

$$(q \times x) + [r \times (m - x)] = m \times s$$

$$\text{therefore } x = \frac{(m \times s) - (m \times r)}{q - r}$$

By fixing m and s and keeping r constant for any curve, x may be found for different values of q. When the points are plotted on co-ordinate paper a set of curves similar to those in Fig. 4 will be produced.

When the melting practice has been established and a chart has been prepared, all possible mixtures may be taken directly from the chart. Slight variations in the analysis of scrap will produce only small changes in the composition of the resulting metal. A separate chart must be used for each different composition of metal required. As most foundries have not more than three standard compositions of castings and the average composition of scrap metals need not vary excessively, a few charts may be prepared and used to great advantage.

Engineering Societies Library

It is perhaps not as widely known as it should be that the United Engineering Societies maintain a very large and efficient library in the Engineering Societies Building, 29 West 39th St., New York City. This library is open to all members of these societies, and to other engineers by courtesy. Members are permitted to withdraw certain books from the shelves, which are mainly duplicates. Most of the readers in the library, however, are interested in matters contained in recent technical periodicals, or are making an extensive search to exhaust a certain subject.

At present the library contains about 117,000 volumes, 32,000 pamphlets and 3,000 or 4,000 miscellaneous pieces of literature. While these are not entirely indexed, in the last 3 years about 150,000 cards have been added to the catalog. There is now available 50,000 subjects presented to prospective readers in a systematic and logical relation. These subjects are handled in two different ways: The searcher who wishes to exhaust his field will find all entries arranged from the large group down to the most minute in one place. The casual reader who wants a minute subject has an alphabetic subject index available.

Legal Notes

By Wellington Gustin
Of the Chicago Bar

Schroder Roofing Patent Invalid

Crushed Slate Used for This Purpose More Than Two Years Before Application

The United States Circuit Court of Appeals has held the Schroder patent No. 1,007,146 invalid because anticipated. The decision was made in a suit brought by the Staso Laminated Slate Co., owner of the patent, against the Stowell Manufacturing Co. 280 Fed. 107.

Crushed Slate Claimed Superior to Ground Product

The patent is for a prepared roofing, which consists of a body portion having a coating of adhesive waterproofing material, such as asphalt and an outer protective coating of crushed slate. The alleged novelty in this patent is twofold: Material and method of application of crushed slate, applied by rolling in contact with an adhesive coating of asphalt. Ground slate had been used in the John's patent of 1872, No. 125,574. It was claimed that crushed slate is superior to other kinds of slate material, because slate laminates when crushed and the laminæ when rolled and pressed together match and overlap one another, so as completely to cover the asphalt coating and give a smooth surface and uniform color which cannot be obtained with a gravel, sand or other crystalline covering. This result cannot be secured, so it was claimed, by the use of ground or powdered slate, because it has no laminæ to match and overlap one another.

The defendant contended that the patent was invalid because Edward J. Schroder was not the original and first inventor, claiming that A. C. Hall was the inventor of substantially the construction described and claimed in the patent which had been in public use or on sale in the United States more than 2 years before the aplication for the Schroder patent.

Similar Product Marketed in 1906

Defendant cited the roofing called "Slateoid" manufactured by the Trinidad Asphalt Manufacturing Co. of St. Louis. This word was registered as a trademark by the company in 1906. It appears that A. C. Hall was employed by the Staso Mills, or Staso Milling Co., of Boston, Mass., as its superintendent from 1906 to 1913. That company was making slate dust in 1906 which was used in making paint and linoleum. This dust had to be screened, and it occurred to Mr. Hall that the larger screenings would make a good material for roofing. He sent samples to various roofing manufacturers, among whom was the Trinidad Asphalt Manufacturing Co. It approved the material and ordered two carloads. The factory of the Staso company was therefore equipped for crushing slate ordered by the Trinidad company. Eight carloads was shipped to that company. The Staso company called the material "torpedo slate." The Trinidad company made and sent sample of Slateoid to the Staso company, and these samples were, Hall testified, like the material manufactured by the Staso Laminated Slate Co. and submitted to him at the trial.

The Trinidad company showed that it manufactured and sold 9,394 squares of "Slateoid," enough to cover 1,657 average size houses, before Sept. 9, 1908, which was 2 years before the application for the Schroder patent. On March 21, 1907, Frank W. Torpening, of the Trinidad company, filed an application for a patent on the Slateoid roofing made by his company. Claim 2 specifies: "A roofing sheet comprising a pliable body, a non-hardening bond applied to said body, and a layer of crushed slate imbedded in said compound, substantially as set forth."

Earlier Application for Patent on Identical Material Rejected

This application was rejected by the Patent Office on the ground that substitution of crushed slate for other material did not constitute invention. This application was filed 3½ years before the Schroder application, using the identical material, crushed slate, and applied in identically the same way.

Complainant disposed of the Trinidad roofing by saying that it was only an experiment and a complete failure, that its manufacture was abandoned, and therefore it should not be held as an anticipation. The court, however, held that such conclusions were not justified by the evidence. It found that substantially the same roofing was successfully manufactured out of the same material, by the same method as described in the Schroder patent more than 2 years before his application. Hence the patent in suit was anticipated and invalid.

The enterprise of the patentee and his assignee was commercially successful. The roofing has been applied in large quantities, both in the form of sheets or roll roofing or shingles. Commercial success is often indicative of invention, but it is not always so, for it may be due to other causes, said the court.

Novel Claim for Damages

Concern Asks Refund for Goods Delivered to It but Not Exportable Because of Embargo

A novel claim for damages is involved in an action brought by the Bencoe Exporting & Importing Co. against the Erie City Iron Works and the John O'Brien Boiler Works Co. The facts appear to be that plaintiff took an order from a Japanese corporation for 300 tons of boiler plates in July, 1917, to be shipped to Yokohama. In order to get the plates plaintiff made a contract with the Aetna Co. to purchase "300 tons of boiler plates for export to Japan," the price being so much per pound "f.o.b. mill Pittsburgh base . . . shipping instructions to be given later." Thereafter the Aetna Co., for the purpose of in part fulfilling its contract, in turn further contracted with the defendant, Erie Works, for 200 tons of the boiler plates. It further appears that at least a part of this order was to be filled through the O'Brien Boiler Works, which in turn had a contract for plates from the Illinois Steel Co. In August, 1917, the President of the United States had ordered that no boiler plates should be delivered for export after certain dates.

Plaintiff charges that the defendant conspired to obtain 200 tons of plates from the Illinois Steel Co. under the latter's contract with the O'Brien Works, by concealing the fact that they were intended to be shipped in fulfillment of an export contract and were not to be

used by the O'Brien Works itself in domestically manufacturing boilers. Having obtained the plates, the defendants shipped the same to the order of the Erie Works in the form required by irrevocable letter of credit previously obtained from the plaintiff. Having been thus paid for, the plates were delivered to plaintiff, but owing to the governmental restrictions they could not be exported nor used to fulfill plaintiff's contract with the Japanese corporation. Plaintiff filed its complaint in two counts, asking $45,000 as damages under the above statement and $50,000 for loss of the sales from the following facts as set out:

The substance of the second cause of action is that on and after Oct. 2, 1917, the plaintiff sold for export certain articles which under the regulations then existing were exportable, providing a license therefor were obtained pursuant to the orders of the President of the United States. The complaint continues that the acts of defendants set forth in the first cause of action, "in procuring by fraud the manufacture and shipment of the boiler plates, were discovered by government agents and reported to the Department of Commerce and by the latter attributed to plaintiff," whereby said department refused all licenses to plaintiff and it lost the sales aforesaid. Its damages were put at $50,000.

The U. S. District Court gave judgment on demurrer and dismissed both causes of action. On appeal the U. S. Court of Appeals reversed the judgment as to the first cause of action and affirmed it as to the second. As to the second, it says a complaint, alleging that illegal acts of defendants were erroneously or stupidly imputed to plaintiff by governmental agents, in consequence of which plaintiff was refused a license to export certain merchandise, the sale of which it had contracted, does not state a cause of action against defendants for damages in the absence of any allegation that defendants communicated with the government agents or in any way caused or contributed to their error.

Exportable Attribute Involves More Than Physical Properties

The court, however, does hold that the first cause of action is a good one, though it is novel and most interesting. The lower court held that the reference in the contract to export of the goods was no more than a "description." Plaintiff contended that what he bought were plates "for export to Japan" and the knowledge that this was plaintiff's bargain was passed on from the Aetna Co. to the Erie Works and to O'Brien. The lower court held the contract required no more than the delivery to plaintiff in the United States of plates physically complying with requirements as to quality, size, etc. Hence since plaintiff had got plates physically acceptable, he had no cause of complaint, for no fraud had been worked on him by anyone, and he got "exactly what he had contracted for." The fact that plaintiff's goods, exactly as contracted for, had been procured for him by frauds or falsehoods worked on the Illinois Steel Co. and the United States was quite immaterial. In terms of the rule of law the lower court held there was no concurrence of fraud and damage to the damage of plaintiff.

But the Court of Appeals could not read the complaint as making the exportable quality or attribute of these boiler plates no more than descriptive. Instead it found that it was part of the original bargain between plaintiff and the Aetna Co., and part of the fractional bargain between Aetna Co. and Erie Works, and something communicated to and known by O'Brien, that plaintiff was not getting what he was entitled to and was not obtaining fulfillment of his contract, unless the plates tendered him had not only the stipulated physical qualities but possessed also the political or legal and additional quality or attribute of exportability.

"Whether there ever was such a singular and burdensome contract we do not know; but we hold it clear that an agreement of that kind is possible, and would be legal, and further that it is such a contract that plaintiff has with reasonable clarity alleged. Therefore he is entitled to an opportunity of proving it before a jury," says the court. (280 Federal Rep. 690.)

Etching Reagent for Steels Containing Chromium and Vanadium

Considerable attention has been paid at the Bureau of Standards to the problem of finding an etching reagent by which chromium carbide could be distinguished from vanadium carbide in a positive and satisfactory manner. Only one out of about twenty reagents tried seemed likely to be of much use in this connection. This is a hot solution of potassium permanganate and sodium hydroxide, etching in which for 1 minute darkens chromium carbide to a strong brown-red or brown color, or rather, the carbon is eaten out, giving the walls of the cavity thus formed a dark brown-red color, while vanadium carbide remains uncolored and apparently unattacked.

Another but less positive means of distinction is that obtained by electrolytic etching with a weak current in a dilute aqueous solution of ammonia or sodium hydroxide. The chromium carbide is eaten out, leaving a dark brown-red or brown cavity, while the vanadium carbide is eaten out apparently at a slower rate, leaving cavities which appear light and not at all darkened.

Second Sorby Lecture

Dr. Cecil H. Desch, professor and dean of the faculty of metallurgy in the University of Sheffield, delivered the "Second Sorby Lecture" on "The Services of Henry Clifton Sorby to Metallurgy." The Sorby lectureship has been instituted by various Sheffield engineering associations to commemorate the work of Dr. Sorby, who rendered such signal service to science in general, and to the special branch of microscopy in particular. It is expected to have a lecture delivered each year by an eminent scientific authority on some subject which arises out of Dr. Sorby's work, and thus promote an increased interest in scientific research. E. J. Thackery, at Sheffield University, is acting as secretary of the fund.

Helium From Canadian Natural Gas

From the physical laboratory at the University of Toronto comes the report that a process for liquefying helium gas has been perfected by Prof. J. C. McLennan. Several years ago Professor McLennan discovered that helium existed in large quantities in natural gas in Canada, and since then various experiments have been made by him to discover such a process.

In 1919 a semi-commercial plant was constructed in Calgary for the extraction of helium from natural gas, the natural gas being piped to Calgary from the Bow Island Field.

Synthetic Ammonia By the Claude Process*

An Outline of Georges Claude's Claims as to the Advantages in the Installation and Operation of Plants Using the Superpressure Method as Compared With the Haber-Bosch Process for Fixation of Atmospheric Nitrogen

TODAY, the production of synthetic ammonia on a commercial scale is well established. As is already well known, the principal process is that of Haber, which is based on the fact that nitrogen and hydrogen are caused to react under the simultaneous influence of pressure (200 atmospheres), heat (about 600 deg. C.) and a catalyst (essentially iron). The process developed by Georges Claude is based on much the same principle, but uses far greater pressure. The difficulties encountered in the use of this superpressure are three in number: Safety, operating difficulties, and cost.

Safety—Obviously, the use of such high pressure calls for very careful selection of materials. There are on the market, however, steel and alloys satisfactory for making tubes which will resist 1,000 atmospheres pressure at 600 deg. C., and catalyzing tubes which will resist more than 5,000 atmospheres. Thus the safety factor is one of construction rather than of construction material.

Operating Difficulties—The main requisite is that the joints be tight. It is known, however, that this depends more on the size of the joint than on the pressure it has to withstand. Considering the relatively small sizes used in the superpressure apparatus to handle the same amount of gas, a tight joint for 1,000 atmospheres, other conditons being equal, is smaller than that needed for 100 atmospheres in some other processes.

Cost—The production of superpressure is not particularly difficult. It will be noted that an ordinary compressor of five cylinders having relative cylinder volumes of 300, 100, 30, 10, and 3 (See Fig. 1) giving 300 atmospheres pressure, will become a supercompressor by the addition of a sixth cylinder having a relative volume of 1, and will be capable of giving 900 atmospheres pressure. Accordingly the additional cost of producing the superpressure is proportionally small.

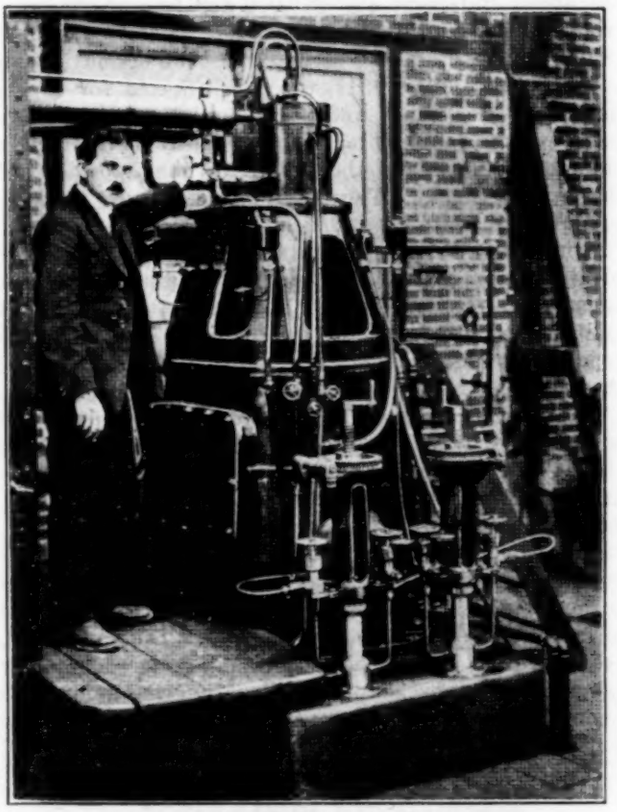


FIG. 2—A SUPERCOMPRESSOR AT THE GRANDE PAROISSE PLANT

This compresses 700 cu.m. of gas per hour to 900 atm.

Fig. 2 shows the size of a two-stage supercompressor capable of supplying pressure at 900 atmospheres to the volume of gas required for a daily production of 5 tons of ammonia or 25 tons of ammonium sulphate. The operation of the supercompressor is comparatively simple and is said to require no special attention. Fig. 3 shows the assembly of the compressor and the supercompressor. It is an eight-stage apparatus of 300 hp., compressing 700 cu.m. of gas per hour to 900 atmospheres. This particular installation is at the Grande Paroisse plant.

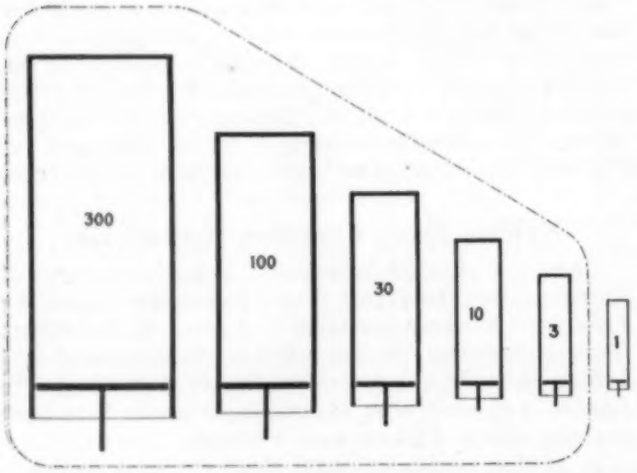


FIG. 1—VOLUME RELATION IN A SUPERCOMPRESSOR

The addition of a sixth cylinder of relative volume 1 added to the five other cylinders changes the 300-atm. compressor into a 900-atm. supercompressor.

Summary of Advantages Claimed

The advantages of the superpressure process have been summarized by Mr. Claude as follows:

While the efficiency of the Haber process in terms of ammonia production is 6 per cent, that of the Claude process can reach 25 per cent. This was proved by actual experimentation carried out in the latter part

*Abstracted and translated by J. S. Negru and S. D. Kirkpatrick from papers appearing in the *Mémoires et Comptes Rendus de la Société des Ingénieurs Civils de France*, Bulletin of April-June, 1922.

of 1917. The curves of Fig. 4 show the relation between the pressure and efficiency in ammonia production at temperatures between 500 and 700 deg. C. Curve I shows the theoretical relation, curve II the relation obtained by extrapolation, based on the results obtained by the Haber process, and curve III the relation as plotted from Claude's experiments.

The increased efficiency is not obtained as a result of increased expense, since the work of obtaining superpressure increases only proportionately with the logarithm of the pressure, and if it costs, say, 2.3 to obtain 200 atmospheres pressure, it will cost only 3.0 to obtain 1,000 atmospheres pressure.

It will be recalled that in the Haber processes the gases are forced to pass through the catalyzer tubes many times, and each time the ammonia produced is withdrawn. By the use of the superpressure process, the reaction is highly intensified and larger amounts of ammonia are formed in smaller volumes. Thus for capacities of 100 cu.m. of gas per hour per liter of catalyzer space Claude produces over 5 kg. of ammonia per kilogram of catalyst per hour instead of 0.5 kg. by the Haber process.

The essential characteristic of the superpressure process, of course, is that the installation is in miniature, and this brings with it a great advantage as to

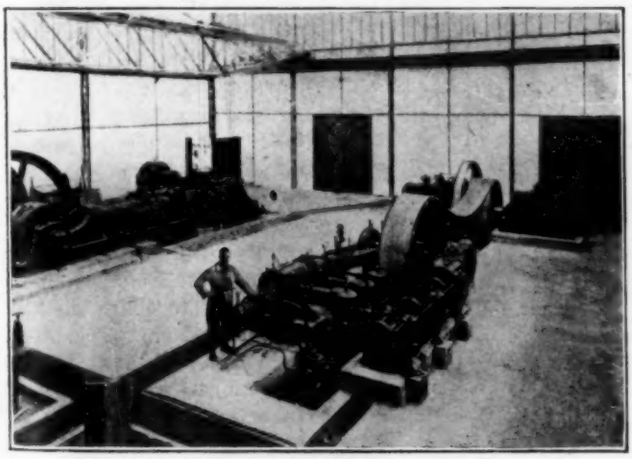


FIG. 3—A 300-HP. SUPERCOMPRESSOR
This machine is for a 5-ton NH_3 plant at Grande Paroisse, compressing 700 cu.m. of gas per hour to 900 atm.

cost of installation and operation. Thus Fig. 5 shows the structure for the five catalyzer tubes of a 5-ton per day ammonia plant. Tubing not larger in diameter than a man's thumb is sufficient for a flow of 700 cu.m. of gas per hour. Fig. 6 shows the assembly of the condensation, extracting and storage equipment required by a plant of 2 tons per day of ammonia. These figures show clearly the small size of plants which are reported to be working with entire satisfaction.

With 1,000 atmospheres pressure, at which an efficiency in ammonia production of 25 per cent is easily obtainable, the vapor pressure of the ammonia produced is 250 atmospheres. As the maximum vapor pressure of ammonia at ordinary temperature is only about 7 atmospheres, it is only necessary to pass the reaction gases through a worm pipe condenser immersed in water to liquefy theoretically $(250 - 7) \div 250 = 97.2$ per cent of the ammonia produced. On the other hand, in the Haber process, a 6 per cent efficiency for ammonia production at 200 atmospheres yields a product under only 12 atmospheres of pressure as compared with 250

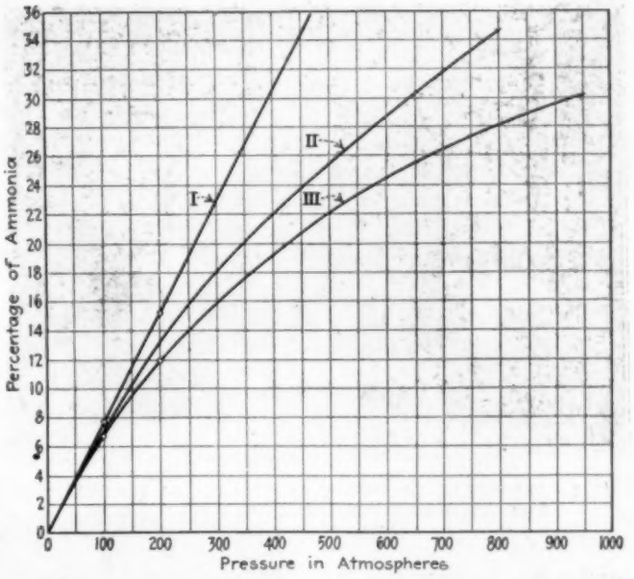


FIG. 4—RELATION BETWEEN PRESSURE AND EFFICIENCY AT THE SAME TEMPERATURES
Curve I—Theoretical relations. Curve II—Extrapolation with Haber's results. Curve III—Claude's experimental results.

in the Claude process, and less than 50 per cent of the formed gas could be condensed with a worm pipe condenser immersed in water. In the Haber process, therefore, it is necessary to remove the ammonia by injecting water under 200 atmospheres pressure, an operation not needed in the Claude process. Furthermore, in the Haber process the water solution of ammonia must be distilled in order to recover the ammonia. Therefore the expense of installation, labor and heat adds to the cost of the final product. In the Claude process, on the other hand, liquid ammonia is obtained as the first product.

Another fundamental difference in the two processes is that in the Haber process the gases must be passed through the catalyzer tubes many times, thus requiring expensive pumps and circulating equipment. In the Claude process it is sufficient to pass the gases through three or four consecutive catalyzer tubes which are separated simply by water coolers. The Claude process therefore does not require the costly heat-exchanging equipment required by the Haber process.

Another very important advantage is allied with the purity of the gases. In the Haber process very high

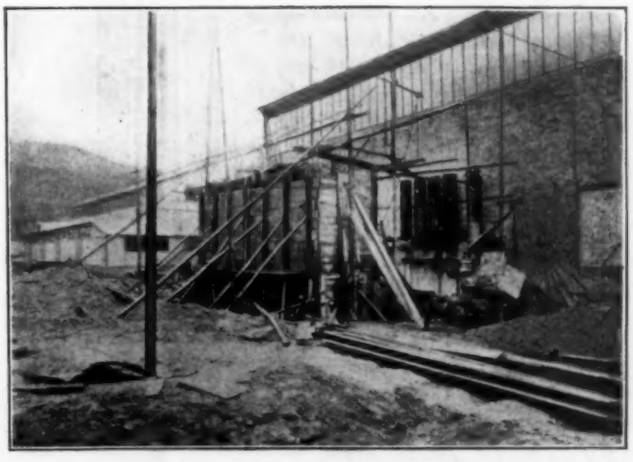


FIG. 5—STRUCTURE CONTAINING FIVE CATALYZER TUBES FOR A 5-TON AMMONIA PLANT

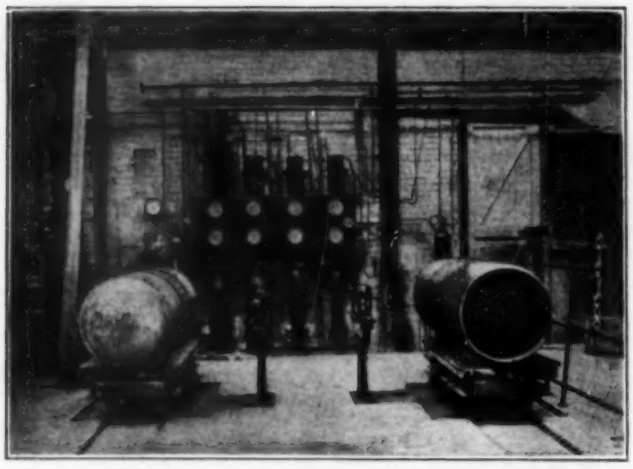


FIG. 6—ASSEMBLY OF THE CONDENSATION, EXTRACTION AND STORAGE EQUIPMENTS FOR A 2-TON AMMONIA PLANT

purification is indispensable. Hence costly absorption towers, batteries of pumps, injectors for circulating under 200 atmospheres pressure the purifying solutions of cuprous formate, caustic soda, etc. In the Claude process these installations are not needed. Here the gases containing as high as 4 per cent of carbon monoxide can be used with entire safety. It is sufficient to pass the supercompressed gases through a simple tube containing reduced iron heated at 300 and 400 deg., whereupon the oxygen burns to water and the carbon monoxide into water and methane, the water being drained out periodically and the methane being without harmful properties as far as the catalyst is concerned. By this simple arrangement the catalyst can last 200 hours.

One of the principal difficulties which was encountered in the superpressure process was to absorb the large amount of heat generated by the reaction. In the Haber process the quantity of heat generated is relatively small, since only 11 per cent of the gases react. In the Claude process, on the other hand, 40 per cent of the gases react under 1,000 atmospheres pressure in a very small volume. As much as 60,000 calories per hour are generated in a tube only 10 cm. in diameter and 2 m. long. This enormous quantity of heat has to be eliminated, and the elimination must take place under the most favorable temperatures so as not to freeze the tubes by too low a temperature and not to destroy the chemical equilibrium by too high a temperature, since this would also destroy the tubes. The problem to be solved was to maintain the catalyst at the most favorable temperature — namely, about 550 deg. C.— and it is necessary that the gases reach the catalyst at this temperature. In the Haber process this is realized by heating the incoming gases with exhaust gases. In the Claude process the special construction of the catalyzer tubes solves the problem of cooling the catalyst, and at the same time enables the heating of the incoming gases with the heat from the catalyst. The catalyzer tubes are constructed as is shown[1] in Fig. 7. The cold incoming gases at *A* are heated progressively by absorbing the heat of the catalyst in the tube *E*. This tube is so proportioned that by the time the reaction gases reach the catalyst at the top they are already heated to the required temperature.

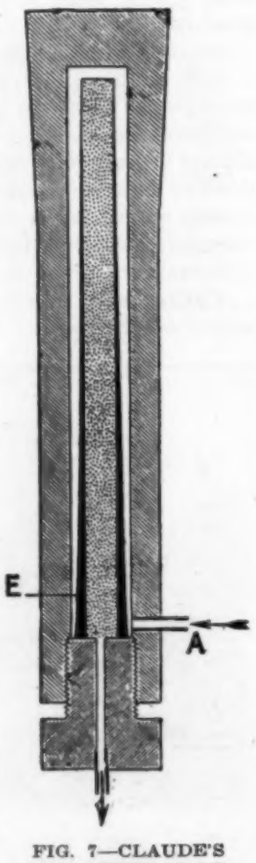


FIG. 7—CLAUDE'S CATALYZER TUBE

By this arrangement both the catalyst and the gases reaching it are at the most favorable temperature without the need of any additional heat exchanges. Furthermore, excessively high temperatures are not reached, so the life of the tube is not endangered.

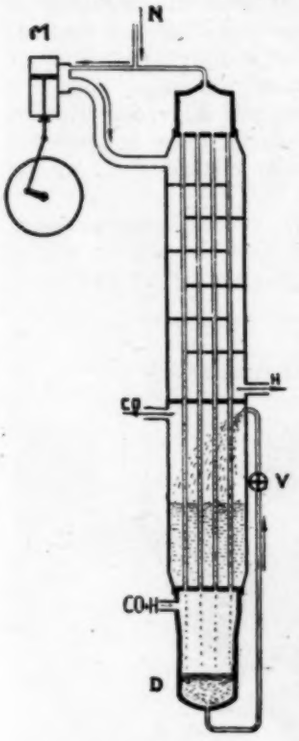


FIG. 8
Production of hydrogen by partial liquefaction of water gas.

This arrangement also has the great advantage of permitting the easy handling of the tube and the substitution of tubes with new catalyzing material, much the same way in which shells are loaded into heavy guns.

It is significant that in the Haber patent reference is made to the use of pressures of 200 atmospheres and more, so that it is now rumored that the Badische Aniline & Soda Fabrik would like to claim the application of the superpressures used by Claude. However, all of the literature of Haber and the Badische company states clearly that they had in view only the highest pressures which were then used industrially, and, of course, the superpressures of Claude have never before had commercial application.

The economic factor of predominant importance in the production of synthetic ammonia is the problem of cheap hydrogen. Here the superpressure process uses a method entirely different from that of Haber. In the latter process the installations for the production of hydrogen must be on a very large scale. In the Claude process the installation for this work is on a very much reduced scale and can easily be installed at places where hydrogen is already being produced as a useless byproduct. Thus utilization could be made of the exceptionally cheap source of hydrogen at coke works to be found in all of the leading industrial centers.

[1] It may be of interest to mention here the typical example of the relation between the chemical and metallurgical industries. The synthesis of ammonia would have been retarded many years if there were no metallurgical products which could resist simultaneously the wide range of temperatures and pressures needed in this important chemical industry. The success of Claude's process is largely to be attributed to the fact that he had unusually good tubes. These were made of an alloy known as B.T.G. of Imphy, which resists perfectly not only the temperatures and pressures used but also the action of the gases. Léon Guillet made a thorough study of this alloy, the chemical analysis of which is C, 0.44; Ni, 60.40; Cr, 8.70; W, 2.52; Mn, 1.80; Fe, 24.73.

It is true, of course, that this crude hydrogen is in realty a complex mixture of hydrogen with nitrogen, carbon monoxide, methane, ethane, butane, ethylene, carbon dioxide, hydrogen sulphide, etc., but Claude has succeeded in purifying it economically. This purification is based on the principle of gas liquefaction, hydrogen being the most difficult to liquefy.

This, of course, is in a field in which Claude's name is already well known. As early as 1903 he had studied the mixture of equal volumes of CO and H (water gas). The gases compressed and purified were cooled and forced to enter a multi-tubular cylinder. (See Fig. 8.) The lower part of the cylinder is immersed in a bath of boiling carbon monoxide, yeilding a temperature of —190 deg. C. at atmospheric pressure. At this temperature, the greater part of the CO in the mixture is liquefied, collected at *D*, and fed through the valve *V* to the exterior bath. The remaining hydrogen and the uncondensed carbon monoxide continue to ascend the tower, where they encounter even a lower temperature at which all of the carbon monoxide is liquefied. This last temperature is produced as follows: Only the pure compressed hydrogen enters the cylinder *M*, where it expands and becomes much colder. This is then returned to the multi-tubular cylinder, thus producing the needed low temperature to liquefy the remainder of the CO in the ascending gases.

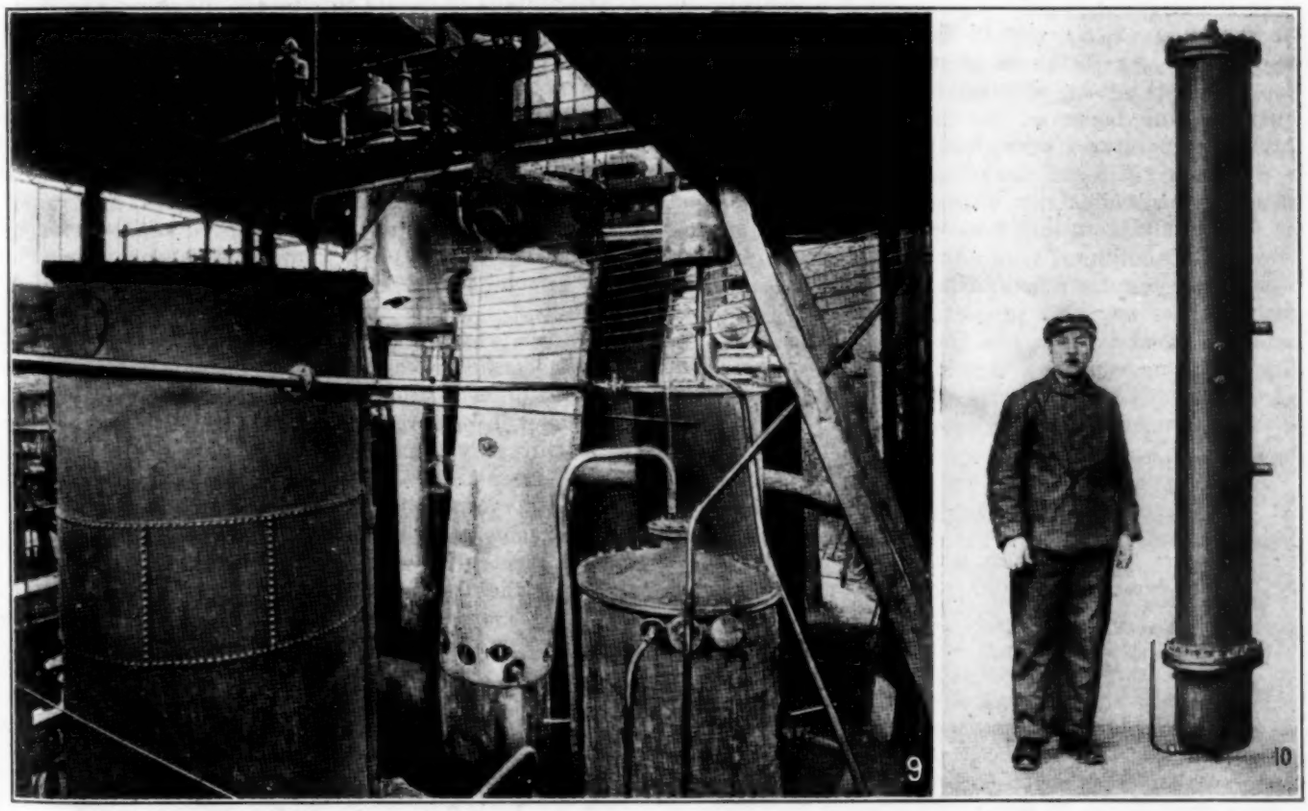
The principal difficulty encountered was that at a temperature of —210 deg. C., needed to condense all of the carbon monoxide, there was no known lubricant which could be used to enable smooth working of the motor. This has been solved, however, by a very simple expedient. As the ultimate aim is to have the mixture of pure nitrogen and hydrogen, the introduction of nitrogen before the hydrogen entered the cylinder *M* is not at all harmful. This nitrogen is immediately liquefied after each expansion and the liquid nitrogen acts as a lubricant, since it freezes only at —210 deg. C. This very simple solution of the problem has been a very helpful step toward the practical success of the superpressure process. And so, instead of having an installation of the size shown in Fig. 9, merely two tubes of the size shown in Fig. 10 will be sufficient for the production of 24,000 cu.m. of pure hydrogen per day.

The problem of purification of hydrogen from coke-oven gas is solved in practically the same manner as has been described for water gas, and an apparatus installed at the coke plant of the Béthune Coal Co. now gives 800 cu.m. of pure hydrogen per hour. A plant is now being erected at this same works which will produce 3 tons of ammonia per day, using this source of hydrogen.

This, it would seem, is the beginning of the practical realization of Claude's plans to have a number of small plants located near the sources of cheap hydrogen and convenient for the cheap manufacture of the finished product (fertilizer).

It may be mentioned that as a byproduct of the operation for the extraction of pure hydrogen from coke-oven gas it will be possible cheaply and completely to extract both the benzol and ethylene.

Although the present variations in the foreign exchanges and labor costs render all figures quite empirical, it may be stated that according to Claude's claims the cost of installation per ton of synthetic ammonia by the superpressure process is less than half the cost when using the Haber process. The relative simplicity of operation of Claude's process and the fact that it can be installed in small units are also to be taken into consideration.



FIGS. 9 AND 10—COMPARATIVE SIZE OF HABER AND CLAUDE INSTALLATIONS FOR HYDROGEN PURIFICATION
Two tubes of Fig. 10 are sufficient to produce the same amount of pure hydrogen as the Haber installation shown in Fig. 9 (24,000 cu.m. per day)

Influence of Cooling Rate on Properties of Carbon Steel

AT THE recent meeting of the American Institute of Mining and Metallurgical Engineers, Francis B. Foley and Joseph Winlock, of the Bureau of Mines, presented the results of an extended investigation, directed by the late Henry M. Howe, on the "Influence of Temperature, Time and Rate of Cooling on the Physical Properties of Carbon Steel." They had ¾-in. bars of well-made acid open-hearth steel, with 0.34, 0.52 and 0.75 per cent carbon. These were heated at a uniform rate in groups in a special electric tube furnace and cooled at various rates, ranging from a retarded furnace cooling (0.01 deg. C. per second through Ar) to a 4-second quench in water, followed by air cooling (20 deg. C. per second).

In the so-called "basal" experiments the temperature of annealing (T_{max}) was 10 deg. C. above Ac_3. This temperature was retained 10 minutes, it having been found that this was sufficient to show no ferrite in a quenched and tempered specimen. Longer times and higher temperatures were also investigated.

Optimum values of the physical properties seem to occur with a cooling rate of about 2 deg. C. per second at Ar (resulting from a 2-second quench in water followed by air cooling, $T_{max} = Ac_3 + 10$). Faster cooling rates lower the ductility and impact resistance; slower cooling rates lower all properties measured. A great mass of basal experiments have been summarized in the following equations, in which c is the percentage of carbon, and R is the rate of cooling in deg. C. per second between Ac_3 and 585 deg. C.:

Proportional Limit
$$= 24{,}750\ (1 + \tfrac{1}{2}c) + [(115{,}225c - 101{,}100c^2 - 12{,}250)\sqrt[3]{R}]$$
Yield Point
$$= 25{,}000\ (1 + c) + [(89{,}680c - 86{,}185c^2 - 8{,}080)\sqrt[3]{R}]$$
Tensile Strength
$$= 50{,}000\ (1 + c) + [(7{,}023 - 11{,}450c + 50{,}780c^2)\sqrt[3]{R}]$$
$$\text{Stress of Rupture} = 118{,}000 + 33{,}200\sqrt{R}$$
$$\text{Per Cent Extension in 2 in.} = 52.1 - 61.4c + 22.4c^2$$
$$\text{Per Cent Contraction of Area} = (79 - 61c)\ R^{.05}$$
$$\text{Charpy Impact} = (51.25 - 111.5c + 64.27c^2)\ R^{.29}$$
$$\text{Brinell Hardness} = (97 + 80c) + 100c\sqrt[3]{R}]$$

It is usually thought that more rapid coolings result in greater hardness at the expense of ductility. As a matter of fact *all* measured physical properties[1] get better with increasing speed of cooling up to the mild quench from $Ac_3 + 10$ deg. C. represented by 2 seconds in water and balance in air. Another unusual fact is found when results of these basal experiments are compared with those having higher and longer periods of heating. It is found that hardness (tensile strength, elastic limit and Brinell number) increases when the 0.52 and 0.75 C steels are quenched from higher temperatures (increasing T_{max}), but *all* properties deteriorate with longer time at T_{max}. Time and temperature have hitherto been supposed to act in the same direction, and they do so in the 0.34 C steel—high T_{max} and long time both damaging the metal. Ductility (elongation, contraction and impact) is impaired by both time and temperature in all carbons, but, as just noted, hardness shows apparent anomalies. These may be studied by examining the relationship between diffusion and grain growth, or coalescence.

It is apparent that the actions going on above Ac_3 are largely diffusion of impurities (including carbon) into austenite, an effect which is practically complete within 30 minutes. As the temperature rises, a second effect appears—namely, the growth of austenite grain. Furthermore, the time spent at or just below the Ar range is largely occupied by the coagulation of the cementite and pearlite formed by the break-up of solid solution.

Now, the ferrite shells in a slowly cooled steel inherit the position of the austenitic grain boundaries—if the austenite was overheated for some time the apparent grain size of the cooled steel reflects that fact. However, the cooling of that austenite may have been at such a rate that the minute ferrite and cementite particles thrown out of solid solution (both in ferrite shells and pearlite cores) are extremely fine grained. Then the coarse grain marked by open ferrite shells would be illusory.

The authors illustrate this by the diagram, Fig. 1.

We may therefore have a fine-grained ferrite-carbide structure in a small network *a*, produced by a fairly rapid cooling of a fine-grained austenite; a coarse-grained ferrite-carbide structure in a small network *b*, which results from a very slow cooling of a fine-grained austenite; a fine-grained ferrite-carbide structure in a large network *c*, which results from a fairly rapid cooling of a large-grained austenite; a coarse-grained ferrite-carbide structure with a large network *d*, which results from a very slow cooling of a large-grained austenite.

The ferrite network of annealed hypo-eutectoid steels must be considered a segregate. If this segregate is made up of very fine crystals it is less harmful than one made up of large crystals. Likewise, the grains of pearlite may consist of coarse or fine carbide and ferrite crystals. It is desirable to produce a structure like *a*; but *c* is far better than *b*.

High temperature anneals give coarse-grained, homogeneous austenite, which upon cooling at mild rates gives a structure like Fig. 1 (*d*). As ferrite is the predominant constitutent in the 0.34 C steel, this treatment will do the most damage by producing what is apparently a very coarse grain, and a general deterioration of qualities ensues. On the other hand, uniform austenite will reasonably be responsible for more uniform and fine crystalline pearlite grains of high quality, so that in the higher carbon steels, where the pearlite is the major constituent, hardening and strengthening of the pearlite grain will occur simultaneously with a lower ductility of the pearlite shells.

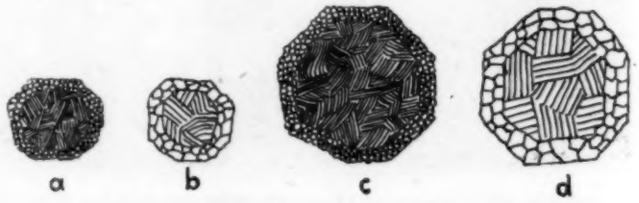


FIG. 1—NETWORK AND GRAIN-SIZE OF FERRITE AND RELATIVE COARSENESS OF PEARLITE LAMELLA

The deduction may be made from all these experiments that ductility and toughness in hypo-eutectoid steel are products of free ferrite, fine crystal structure in both the pearlite and the ferrite binder, and homogeneity in chemical composition.

[1]Except contraction in area, which remains stationary.

Pitch Troubles in Newsprint Paper Mills

By Frederick Barnes
Chief Chemist, Belgo Paper Co., Ltd., Canada

THE modern newsprint paper industry has a number of problems on its hands which will have to be solved in the near future in order to increase the efficiency of the present and future plants. It is quite probable that some of these problems have been already solved in more than one mill, but if so those mills have been careful to avoid letting any information leak out for the general benefit of the industry.

One of the frequently met problems is to discover the cause of periodical "pitch" troubles on paper machines. At one time or another nearly all the mills in northeastern America and Canada have had more or less severe trouble caused by pitch. This pitch coats the suction boxes, wires and felts of the paper machines and causes heavy losses in time and output, due to the necessity of having to shut down the machines to "clean up." Most of the trouble occurs in the summer, when the mills are drawing their supply of raw material from "green" wood out of the riers. In the other seasons, when the mill supply comes from the block pile, the pitch trouble is either nonexistent or occurs in a modified form at rarer intervals.

Spruce wood, the principal source for newsprint paper, is the worst offender in introducing pitch troubles. Not from the ground wood pulp but from the sulphite pulp portion of the stock comes the principal difficulty. High-temperature cooking of sulphite, careful seasoning of wood, cleanliness, and keeping down the temperature of dilute stock for paper machine are all factors which reduce pitch troubles.

It is a rather remarkable fact that in the past 10 years of rapid expansion of the newsprint industry in Canada few attempts seem to have been made to explain the why and wherefore of this important problem. It is proposed in this article to give some idea of some of the work done on it, mainly by the present writer, with some significant results obtained by direct experiment.

Origin of Pitch Trouble

The starting point of the so-called "pitch" is the resinous matter in the coniferous trees which supply the raw material for newsprint paper. In eastern Canada the conifers used are black and white spruce, balsam fir and jackpine, while in the northeastern United States, hemlock appears to take the place of the jackpine of Canada. The present article deals with the Canadian trees only.

The resinous matter, or pitch, found in coniferous trees is that portion of the wood which is obtained by extraction with ether and then with alcohol. The ether extract is usually soft and sticky, while the alcoholic extract is much harder and clearly of a resinous nature. According to Schwalbe, the average extract contains about 50 per cent of rosin-fat. This authority and others maintain that it is this rosin-fat which is the main factor in pitch troubles. Apparently, there is reason to suppose that their statements are correct. This rosin-fat portion of the pitch is soluble in petroleum ether and is said to be mainly a glyceride of linoleic acid, $C_{18}H_{32}O_2$, while the insoluble portion is a hard resin which closely resembles the ordinary resin of commerce. If either one of these constituents is absent, pitch troubles do not occur. Seasoning the wood has a powerful influence on the pitch contained therein. According to Sutermeister, chipped wood seasons in 3 weeks, while 2 years is required to season wood in the log form. Seasoned wood gives little or no pitch troubles as a rule.

Table I gives an idea of the composition of the pitchy deposit from paper machines. The composite nature of these deposits will be evident from these figures. Apparently the resinous pitch, on its passage through the beaters, mixers, stock tanks and over the paper machine, picks up all kinds of finely divided foreign matter. It is evident that the cleaner the stock is kept the less the trouble from pitch deposits.

In one particular case examined, the pitch contained a large percentage of finely divided brass, which had evidently come from the Fourdrinier wire. In this case it appeared that the pitch trouble had been aggravated by a badly adjusted Fourdrinier wire, the fine particles of brass quickly forming a substantial deposit when picked up by the soft pitch.

Persons not familiar with newsprint mills might suppose that the pitch problem would be easy for an investigator, but it is really quite difficult to solve. This is due to a combination of factors—the large output, the speed of production and, based on these, the ease with which small original troubles rapidly grow into formidable obstacles. Further, the modern newsprint mill is really a combination of three entirely different operations in three different mills under three different superintendents, each with his own particular ideas as to how things should be done. In addition, the auxiliary operations such as wood preparation and forestry operations must be considered. Thus, the investigator may conduct a lot of painstaking work in Soxhlet extractions, etc., and form a working theory as to how the trouble has occurred, only to find that his theory has been ruined by some change in operations in one of the three mills.

When pitch trouble is at its height, the operator has his own pet theories as to what causes the trouble. One

TABLE I—COMPOSITION OF "PITCH"

1912 Analysis	Per Cent	1913 Analysis	Per Cent	1914 Analysis	Per Cent
Mineral grease	9.0	Mineral grease	12.35	Solid grease and resin	55.0
Saponifiable resin and oil	34.6	Saponifiable resin	42.15	Soap and color	8.7
Coloring matter	2.2	Aniline blue and soap	11.80	Inert pitch	24.7
Ash	4.4	Inert pitch	21.50	Ash	3.8
Inert pitch	49.6	Ash	4.90	Undetermined	7.8
	99.8	Brown flocks	7.00		100.0
			99.70		

of the commonest ideas is that it is due to grinding the wood in the mechanical pulp mill at too high a temperature, and this idea is put forward in one of the latest books on the pulp and paper industry. In the writer's opinion this idea is quite wrong, except in so far as a high grinding temperature tends to produce considerable flour stock and makes the pulp "slow." In the presence of pitch this fine stock is likely to be picked up by the soft pitch, causing immediate trouble, while a "freer" stock, ground at a lower temperature, would not be so likely to behave thus.

Apart from this it seems obvious that the mere mechanical operation of grinding wood on a stone, even at temperatures as high as 185 deg. F., cannot conceivably cause pitch trouble to originate. Theoretically, the higher the temperature of grinding the less should be the pitch trouble, as the higher temperatures would tend to split off volatile terpenes and modify the so-called rosin-fat which causes the trouble. In connection with this question of temperature of grinding, it is interesting to consider that in Norway about 15 years ago (if not now) both the "hot" ground and "cold" ground processes of making mechanical woodpulp were practiced side by side in the same mill, and the writer had the opportunity of observing these two processes in several of the Norwegian mills at that time. Samples of hot-ground and cold-ground pulp from these mills were extracted by ether, giving the results shown in Table II. The wood used in the Norway samples is believed to have been entirely Norway spruce, the chicoutimi sample being 90 per cent spruce and 10 per cent balsam, and the North Shore sample probably 100 per cent slow grown spruce.

TABLE II—ETHER EXTRACTION OF HOT- AND COLD-GROUND PULP

Wood	Per Cent Ether Extract Hot Ground	Cold Ground
Norway, *Honefos C*	....	0.37
Norway, *Vittingfos "V"*	....	0.35
Norway, *Honefos L*	0.35	....
Norway, *Honefos A*	0.30	....
Norway, *Vittingfos E*	0.50*	....
Canada, *Chicoutimi X*	0.32	....
Canada, *North Shore*	0.31	....

* Probably an experimental error.

There is not much comfort in these figures for the paper mill men who say that "hot" grinding causes pitch trouble. One would suppose from their argument that the hot-grinding process actually increased the pitch content of the ground wood. This latter is interesting when we consider sulphite pulp.

Another idea prevalent in the paper mill in times of pitch trouble is that balsam fir causes the trouble. This idea apparently is based on nothing more substantial than the fact that the bark of balsam exhibits much "Canada balsam"—a gummy deposit, noticeable by everyone. Of course all this bark is "rossed" off before the wood is used, so that theory seems scarcely logical. Again, jackpine has been frequently described as the offender in pitch troubles, with little more justification than in the case of balsam. The other tree or trees—namely, black and white spruce—which comprise the majority of the wood used, seem to have been hardly considered as a possible source of pitch trouble, yet we are told that the spruces contain rosin or pitch ducts, while balsam contains none. Jackpine of course is resiniferous.

Extraction Tests

By Soxhlet extractions of the various woods, first with ether and then with alcohol, we get somewhat

TABLE III—SOLVENT EXTRACTION TESTS ON WOODS

Sample	Wood	Per Cent Ether Extract	Per Cent Alcohol Extract	Total Extract
1	White spruce (seasoned)	0.40	0.36	0.76
2	Black spruce (seasoned)	0.24	0.36	0.60
3	Balsam (seasoned)	0.85	....	....
4	Balsam (green)	1.20	1.35	2.55
5	Balsam (punky) (rotten)	0.87	1.71	2.58
6	Jackpine (seasoned) (large tree)	2.70	0.99	3.69
7	Jackpine (green) (small tree)	3.24	1.71	4.95
8	Jackpine (river) (seasoned)	2.37	0.77	3.14

TABLE IV—SOLVENT EXTRACTIONS BY JOHNSEN AND HOVEY

Wood	Per Cent Ether Extract	Per Cent Alcohol Extract	Per Cent Total Extract
White spruce	0.516	0.473	0.989
Black spruce	0.32	0.367	0.687
Balsam fir	0.48	0.94	1.42
Jackpine	1.17	0.442	1.61

TABLE V—SOLVENT EXTRACTIONS BY RICHTER

	Ether Extract	Alcohol Extract
Fresh balsam	0.45—0.85	1.15—3.65
Fresh spruce	0.70—1.80	0.70—1.94

TABLE VI—ROSIN-FAT CONTENT OF PULP WOODS

Wood	Per Cent Total Resin	Per Cent Soluble in Petroleum Ether
Black and white spruce	0.80	56
Balsam	1.70	38
Jackpine	1.85	54

different figures for the various woods. The figures of different experimenters do not agree very well. "Green" wood gives different figures from "seasoned" wood of the same species, and the amounts of ether-alcohol extracts vary with the particular part of the tree examined, so that no very definite figures can be given. Table III gives some figures obtained by the present writer.

In reference to Table III, numbers 1, 2, 3 and 6 were sample slabs, cut from large trees by the forestry department and well seasoned in a dry atmosphere over a relatively long period. No. 4 balsam was a freshly cut 7-in. diameter log, cut 6 miles south of Shawinigan Falls and brought in by sleigh. No. 5 balsam was a 4½-in. diameter log grown in the Abitibi district and probably cut from dead standing timber, as it was badly deteriorated. This sample shows the effect of seasoning, in a decrease in ether soluble constituents and increase in alcohol-soluble substances. No. 7 was from a 5½-in. diameter jackpine, cut by the writer personally for the purposes of this investigation. It was cut in the bush, about 70 miles beyond La Tuque, on Sept. 26, 1922, and the extractions made within 3 days of the cutting. No. 8 was from a 5¾-inch jackpine log taken from the river on Oct. 5, 1922. This was evidently not "green" wood, as it contained only 20 per cent of moisture. Apparently it was seasoned wood, river driven for a short time. The figures therefore are comparable with those of No. 6.

Table IV gives a set of figures obtained by Johnsen and Hovey.

It will be noticed that there are quite large variations between the several sets of figures. On the whole, it might be judged from these figures that balsam and jackpine would most likely be the trees to give pitch troubles.

Referring back to the statement that so-called "pitch" contains about 50 per cent of "rosin-fat," which is the cause of pitch troubles and which is soluble in petroleum ether, we are led to consider Table VI, based on Johnsen and Hovey's figures. From these figures we

see that spruce extract has the highest rosin-fat content, followed closely by jackpine extract, and with balsam much the lowest of the three.

Table VII gives a series of extractions made on ground woodpulp during times of pitch troubles and also during normal operation. We see by this table that there was less ether-soluble rosin in the pulp during pitch trouble times than in the periods of normal operation.

TABLE VII—ROSIN-FAT CONTENT OF GROUND WOOD PULP DURING PITCH TROUBLE AND IN NORMAL OPERATION

Date	Per Cent Ether Extract		Per Cent Alcohol Extract	Per Cent Total Extract	Pitch Troubles
7/20/21	0.45		....	....	Yes
11/ 3/21	0.38	0.55	1.25	1.63	Yes
11/ 2/21	0.82		0.98	1.80	Yes
11/10/21	0.83		0.61	1.44	Nil
11/10/21	0.70		0.86	1.56	Nil
6/12/14	1.22				
6/13/14	0.55				
6/15/14	0.89	0.85			Absent
6/16/14	1.05				
6/17/14	0.38				
8/29/14	1.03				

Table VIII gives a series of extractions on sulphite pulp mainly during pitchy periods. Referring to Table VIII, No. 1 shows the figures for "green" wood from the river. No. 2 shows figures for partly seasoned wood from the log pile. The extracts in No. 2 are lower than in No. 1. No. 11 was the case mentioned above, where the pitch was found to consist very largely of brass fragments, from machine wire. The figures show a low amount of resin. The reason for pitch trouble in this case was the highly contaminated (with dirt) state of the stock running on to the paper machine and a badly adjusted machine wire. The figures of Table VIII show, on the average, higher extractions during pitchy days, but otherwise there is nothing particular to be learned from them. The figures for jackpine sulphite show large amounts of ether extractions, yet no pitch troubles were experienced, probably due to the fact that the wood was seasoned.

TABLE VIII—ROSIN-FAT CONTENT OF SULPHITE PULP

Test No.	Date	Description	Per Cent Ether Extract	Per Cent Alcohol Extract	Per Cent Total Extract	Pitch Troubles
1	6/1–10/15/20	Average B.C.P.S.	1.36	0.68	2.04	....
2	12/1/19–3/15/20	Average B.C.P.S.	1.02	0.63	1.65	....
3	7/20/21	B.C.P.S.	1.29	....	....	Yes
4	10/27/21	B.C.P.S.	1.41	0.29	1.70	Yes
5	11/ 2/21	B.C.P.S.	1.67	0.75	2.42	Yes
6	12/11/21	L.P.S.	1.33	....	....	Yes
7	.....	Swedish Sulphite	1.15	....	....	....
8	.....	U. S. A. G. N. S.	1.46	....	....	....
9	10/10/13	L.P.S.	1.75	0.60	2.35	Yes
10	9/21/15	B.C.P.S.	1.53	0.86	2.39	Yes
11	1919	B.C.P.S.	1.27	0.38	1.65	Yes
12	3/ 3/21	Jackpine B.C.P.S.	2.23	0.42	2.65	Nil
13	3/ 4/21	Jackpine B.C.P.S.	2.02	0.43	2.45	Nil

In the whole series of extractions given above for wood, ground wood and sulphite, there is little which points out the cause of pitch forming on paper machines. There have been a number of attempts at explanation by various people, some of the explanations being quite opposed to one another. Cooper states that the trouble originates in the acid system, due to leaks in the gas line, forming particles of calcium sulphate, around which the pitch forms. The present writer has never found excess SO_2 in the burner gases during pitch trouble times and has always held the opinion that the trouble originates in the sulphite pulp alone, to a certain extent irrespective of what species of wood is being cooked, and that only by certain modifications in the cooking process can this trouble be overcome.

Prevention of Pitch Troubles

It has been commonly taken for granted that balsam fir and jackpine are the original culprits, and few persons seem to have thought of spruce as a possible starting point, yet spruce is still the main factor in newsprint making. Wimmer[1] makes some very significant remarks in relation to pitch troubles, emphasizing the following:

1. Many mills using spruce for sulphite are bothered by pitch.
2. To avoid pitch trouble, allow wood to season properly and use hot water to wash stock.
3. It is proved that excessive heat in cooking destroys pitch entirely.
4. When using green or half dry wood (spruce) use a higher free SO_2 and less combined.
5. Use a specially high percentage of MgO in the lime.
6. Put all relief liquor down drain.
7. Arrange for special cooking, so as to reach a temperature of nearly 160 deg. C. before blowing.
8. Use felt covered riffler boards and change often.

These remarks, especially the ones relating to cooking at a high temperature, are most significant, as they are quite in line with what the present writer has found to be the case, working quite independently. Wimmer also stresses spruce as causing the trouble.

The figures in Table VIII show that the wood, in going through the sulphite cooking process, does not lose much of its "pitch" as expressed in ether and alcohol extracts. Lieber states that only about 4 per cent is actually removed in the cooking process, the remaining 96 per cent being left in the cellulose when it is blown out of the digester. This fact alone ought to indicate that it is the sulphite pulp and not groundwood pulp which causes pitch trouble. The writer has examined numerous batches of sulphite pulp during pitchy periods and frequently found relatively large quantities of pitch fragments.

Determining Proper Cooking Temperature

During the past summer pitch troubles were very bad at intervals and a strong endeavor was made to find a remedy. During an especially troublesome period it was noticed that a quantity of twisted and cracked spruce logs were coming from the river. Some of these logs showed much resinous deposit and one particular log, about 9 in. in diameter, was put on the log splitter and split lengthwise. The log had a long wind-crack down the length of the wood and this was filled with a sticky semi-liquid deposit of brown rosin, clearly showing where the pitch trouble was coming from. There was such a large quantity of this sticky deposit that it offered an excellent opportunity for extended investigation. To try the effect of variations in cooking temperature on the pitch, the writer inclosed numerous samples of this pitch in sealed glass tubes, with spruce wood chips and bisulphite cooking liquor and cooked these at varying temperatures.

The results of several of the experiments were most significant and it was found that the pitch remained soft and runny at temperatures up to nearly 300 deg. F. (149 deg. C.), but as this temperature was nearly reached, the pitch began to harden and at temperatures

[1] *Pulp and Paper Magazine* (Canada), vol. 15, No. 19.

between 150 and 155 deg. C. a decided modification took place in the previously runny pitch. This change, which resulted in a decided hardening of the resinous matter, probably was due either to a splitting off of volatile terpenes or to a drastic modification of the rosin-fat constituent. On opening the tubes it was found that the pitch had not only hardened very materially but had nearly lost its sticky quality. In a tube that had been kept at a maximum heat of about 145 deg. F. the pitch was, if anything, more sticky than when it was put into the tube.

These experiments showed conclusively that 150 deg. C., or about 302 deg. F., was a critical temperature for the pitch and suggested at once that temperatures not below these should be used in cooking if pitch trouble was to be avoided. Previous to this, the common practice in cooking had been to reach a maximum temperature of about 143 to 144 deg. C. In the light of the above experimental results, the cooking temperature was at once put up to a maximum of 150 to 155 deg. C., with the gratifying result that the pitch troubles in the paper mill showed a most conspicuous decrease, and that during the warmest and most pitchy month of the year—August.

It is suggested that to avoid pitch troubles, the following points be observed:

1. Throw aside all logs showing evidence of windcracks and showing resinous matter.
2. Bring the temperature of the cook before blowing to at least 150 deg. C. and preferably to 155 deg. C. for, say, half an hour to an hour. (Possibly less time would do.)
3. Keep the stock, whether groundwood, sulphite or machine stock, free from dirt, including such things as undissolved dyestuffs.
4. Keep the groundwood pulp as "free" as is possible in good practice.
5. Keep the temperature of the dilute stock running on the paper machine as low as is practicable.
6. Season all wood as far as is practicable.

SUMMARY

1. Groundwood pulp is probably never the starting point of pitch troubles.
2. Spruce wood and not balsam or jackpine is probably the first cause of pitch trouble.
3. Experiments carried out by the writer show that if pitchy pulp be raised to temperatures above 150 deg. C. in the digester, pitch troubles on machines are almost eliminated.
4. When using pitchy wood (green) the manner in which sulphite cooks are made, particularly as regards temperature, determines whether pitch trouble will occur or not.

Correction

In the Feb. 28 issue of *Chem. & Met.*, in an account of the recent national boll weevil meeting at Atlanta, Ga., we included part of the address on the arsenic and calcium arsenate shortage as having been delivered by "Howard Armbruster" of New York.

As will probably have been surmised by our readers, the author's correct name is Howard W. Ambruster, whose previous contributions to *Chem. & Met.*, will be remembered as having prophesied months ago the acute shortage of arsenic which finally developed as a result of the boll weevil situation.

Dealers Forbidden to Pose as Manufacturers

Progressive Action Taken in Paint Case by Federal Trade Commission

The Federal Trade Commission has recently decreed that a firm advertising as a manufacturer and not owning or controlling a factory is engaging in unfair competition. The American Turpentine Co., a firm trading under the name of the North American Fibre Products Co. and situated in Cleveland, Ohio, advertised in such a way as to indicate that its products (paints, varnishes, etc.) were manufactured in its own factories. Purchasers were thereby led to believe that they were saving the cost of a middleman.

On investigation, it was discovered that neither the American Turpentine Co. nor the North American Fibre Products Co. owned or controlled factories located in various cities throughout the United States, and that these factories listed in their advertisements were in reality those of manufacturers from whom they purchased goods for resale purposes. The commission has therefore issued an order that a firm must not advertise as a manufacturer unless factories are actually owned or operated by it.

Sulphur-Free Lye Used for Odorless Manufacture of Chemical Pulp

The majority of the cellulose industries in Sweden have adopted a newly invented method of producing cellulose, under the supervision of E. L. Rinman, according to a recent article in *Canadian Chemistry and Metallurgy*. Lyes are used that are free from sulphur, and chemical products of high value are produced from the organic substances that have been dissolved by the waste lye. The sulphate method uses sulphur-bearing lyes and consumes as fuel the organic substances contained in the waste lyes. In the actual production of cellulose, the two methods are not unlike. They differ essentially, however, in the comparison of the boiling solvent, as well as in the further treatment of the waste lye.

By the use of a sulphur-free lye, Dr. Rinman has succeeded in making the manufacture of cellulose entirely odorless, thereby overcoming a difficulty which countless efforts in the past have failed to remove. Moreover, considerable economic advantage results from the utilization of the large amount of organic substance, comprising from 50 to 60 per cent of the volume of the wood which normally escapes during the boiling of the cellulose and passes into waste lye.

Spontaneous Changes in Precision Balances

The Bureau of Standards has carried out successive tests on two of its highest grade analytical balances. These balances have been used constantly but with extreme care for some years. Both balances showed appreciable changes in the ratio of the arms of the beam which could not be explained as the result of wear of the knife edges. The bureau considers that these alterations are the effect of spontaneous changes in the beam, probably caused by the gradual release of stresses set up during the manufacture of the balance. This study corroborates evidence of such changes noted in many balances of this type and supports the long-established policy of recommending that analytical and similar balances be checked occasionally by the users.

Synopsis of Recent Chemical & Metallurgical Literature

Marketing of Chromite

The chemical industry is one of the large consumers of chromite, which it uses for the manufacture of sodium and potassium chromates and bichromates, chromium pigments and various derivatives used in tanning and dyeing. Edward Sampson, of the U. S. Geological Survey, in an article in the Feb. 24 issue of *Engineering & Mining Journal-Press*, makes the following statement regarding the industrial consumption of chromite:

"Recently one of the largest importers made an estimate for me of what he considered the present requirements of these industries. The following are his figures as compared with the 1918 estimate of the War Industries Board:

ESTIMATED CONSUMPTION OF CHROMITE, IN PER CENT OF TOTAL

	1918	1922
Ferrochromium	52	40
Refractories	17	35
Chemicals	31	25

"The 1918 estimate was on the basis of a consumption of 130,000 tons and the 1922 estimate is on the basis of a consumption of about 110,000 tons, which is probably too high."

Domestic sales, imports and apparent consumption of chromite in the United States in 1917 and 1917-21 are shown to have been as follows:

(In Long Tons)

Year	Domestic Sales	Imports	Apparent Available Supply
1913	255	65,180	65,435
1917	43,725	72,063	115,788
1918	82,430	100,142	182,572
1919	5,079	61,404	66,483
1920	2,502	150,275	152,777
1921	282	81,836	82,118

How Chromite Is Sold

Chromite is usually sold on yearly contract or in shipload lots. Sampling is by an independent chemist, and payment is made according to his report. The common terms are 75 per cent on arrival of steamer, and the balance on report of sampler.

The basis on which the price is fixed varies according to the use to which the ore is to be put. Ore for refractories is sold at a flat price with a guaranteed chromic oxide content—for example, 40 per cent, rejectable if below 38 per cent. A minimum quantity of silica is guaranteed in ore for refractory purposes—generally a minimum of from 5 to 8 per cent. Ore for ferrochromium and for chemicals is paid for according to the chromic oxide content. At present such ore is sold on the basis of 50 per cent Cr_2O_3, with an adjustment per unit above or below that figure. The unit is 1 per cent of Cr_2O_3 per long ton. During the war domestic chromite was sold on direct unit-price basis, the unit price varying according to the grade of the ore. The sale of chromite by the long-ton basis is a reflection of the fact that British interests have long controlled the market.

Nitrogen Distribution in Vertical Retorts

The problem of the reaction of nitrogen in coal during treatment in gas works is one of the important problems of the gas industry today. In the *Gas Age-Record* for Feb. 14, 1923, C. H. Stone, of the Rochester Gas & Electric Corporation, discusses the subject of the distribution of nitrogen in the products of carbonization obtained from vertical retorts.

It is stated that the subject of nitrogen is particularly important at the present time, due to the increased production of ammonia which follows on the increased use of the byproduct oven for gas production.

Yield of Ammonia

At present only 15 to 25 per cent of the nitrogen in the coal is recovered as ammonia, the remainder going mostly into the coke, partly into the tar, and partly into the gas. In the A.G.I. report for 1908 we find that for horizontal retorts 43.31 per cent of the total nitrogen in the coal goes into the coke as nitrogen; 2.98 per cent goes into tar as nitrogen; 15.16 per cent goes to liquor and gas as ammonia; 1.43 per cent goes to liquor and gas as cyanogen; and 37.12 per cent goes into the gas as nitrogen, or is accounted for as lost.

The *Journal* of the Society of Chemical Industry, vol. 23, page 581, states that the ammonia yield is 34 per cent more in vertical retorts than in horizontal, and the following table is given for the distribution of nitrogen:

N_2	Foster	Knoblauch	McLeod	Short
As NH_3	14.50	12–14	17.1	15.16
As CN	1.56	2.0	1.2	0.43
In coke	48.68	50.0	58.3	43.31
In tar	....	....	3.9	2.98
In gas	35.26	30.0	19.5	37.12

Yields by Various Processes

The following table gives some idea of the yield of ammonia from various methods of retorting coal. Of course the yield obtained varies from day to day with the kind of coal, with the heat used, with the amount and duration of the charge, with the amount of steam admitted, and other factors. This table gives also results from two horizontal retorts and one inclined retort in order to form a basis of comparison between the different types of retorts. Bolz in *Journal of Gas Lighting* gives the ammonia produced in per cent from different kinds of installations as follows:

Bolz	Dessau	Munich Chamber	Incl. Retorts	Incl. Retorts	Hor. Retorts
0.325	0.325	0.26	0.26	0.26	0.26

Inclines—Frank Huber, *Proc. A. G. L.*, 1914, average for 13 years, NH_3, 5.002 lb.

As shown by these figures, there is a wide divergence both in the yield of ammonia and in the distribution of the nitrogen in products of carbonization. For this reason it is necessary to make determinations of these figures for every individual installation, and with that fact in mind the author of this paper investigated the plant with which he is connected at Rochester, N. Y.

The Investigation at Rochester

The installation at Rochester consists of U.G.I. vertical retorts, each holding 1 long ton of coal. These retorts are ordinarily charged at intervals of 11½ hours. The temperatures used are 2,300 deg. F. at the bottom and 1,600 deg. F. at the top of the retort. The gas passes directly from the retort through the hydraulic main to a primary condenser of the Doherty washer-cooler type, in

Important Articles In Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. Those that are of unusual interest will be published later in abstract in this department; but since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

Gas Producers. T. R. Wollaston. *Iron and Coal Trades Review*, Feb. 9, 1923, p. 196.

Heat-Treatment of Electric Carbon and Alloy Forging Steels. Larry S. Barton. *Forging and Heat Treating*, February, 1923.

Copper-Aluminum-Nickel Alloys. Leon Guillet. *Rev. Met.*, February, 1923.

Leaching and Evaporating: Account of Discussions by Chemical Engineering Group, Society of Chemical Industry, under Chairmanship of J. A. Reavell. *Chem.*, pp. 147-8, Feb. 16, 1923.

Problems Connected With Saponification of Fatty Oils. H. M. Langton. *J. Soc. Chem. Ind.*, pp. 51-57T, Feb. 16, 1923.

Some New Derivatives of Bituminous Coal. Archibald R. Pearson. *J. Soc. Chem. Ind.*, pp. 69-72T., Feb. 16, 1923.

Elimination of Waste in Paper Making. B. T. McBain. *Paper*, Feb. 28, 1923, vol. 31, No. 19, pp. 7-9.

China Clay Industry. Supplement *Chem. Age* (London), Feb. 17, 1923.

Efficiency of the Basic Open-Hearth Process. *Iron and Coal Trades Review*, Feb. 9, p. 183.

New Electrically Operated Top-Roll Balancing Gear. *Iron and Coal Trades Review*, Feb. 2, p. 161.

New Design of Continuous Furnace. *Iron and Coal Trades Review*, Feb. 2, p. 155.

The Flow of Metal During Forging. *Forging and Heat Treating*, January, 1923, p. 25.

Technical Vocabulary of the Foundry. *Brass World*, January, 1923, p. 4.

which it is cooled by a spray of weak ammonia liquor. It then passes to the exhauster, through a second washer-cooler, to the intensive scrubber, purifiers, light oil scrubber, feeder and holder.

The coal used at Rochester showed 1.75 per cent nitrogen and the coke showed 1.16 per cent. Therefore 0.94 per cent of the weight of the coal was the amount of nitrogen to be distributed among the products of carbonization. This is with an assumed make of 70 per cent coke. The total free nitrogen in the gas which came from the coal was 1.73 per cent by volume. Of the nitrogen in the products of distillation we find the following distribution:

	Per Cent Nitrogen by Weight
Lower hydraulic:	
Liquor and tar contain as NH_3	0.10
Tar contains as CN	0.000007
Liquor contains as CN	0.00045
Upper hydraulic:	
Tar contains as NH_3	0.13
And primary liquors contain as NH_3	1.37
Tar contains as CN	0.00048
And primary liquors contain as CN	0.016
Primary tar contains as NH_3	0.77
Primary tar contains as CN	0.00039
Gas contains as NH_3	21.94
Gas contains as CN	2.64
Gas contains as nitrogen	73.01

Calculating the ammonia from all sources, the results are as follows:

Total yield:	Lb.
From coal	5.58
In gas at outlet of primary	976.47
In lower hydraulic tar and liquor	4.45
In upper hydraulic tar	5.91
In primary tar	34.44
In primary and upper hydraulic liquors	61.03
For the 12-hour test, all sources	1082.30
Now 0.94 per cent of the weight of coal, as nitrogen, would yield	4441.00

so that we find $1082 \times 100 + 4441$, or 24.4 per cent, of the possible ammonia yield was obtained. This shows pretty conclusively where there is room for improvement.

Results From the Test

Incidental to the test the following was ascertained:

	Gal.
Total tar and liquor from the lower hydraulic for 24 hours (w)	473.6
Total tar from the upper hydraulic for 24 hours (x)	5249.8
Total tar from the primary hydraulic for 24 hours (y)	2555.4
Total liquor from primary and upper hydraulic for 24 hours (z)	1317.6
Grains of ammonia per gal in (w)	131.5
Grains of ammonia per gal. in (x)	15.8
Grains of ammonia per gal. in (y)	188.7
Grains of ammonia per gal. in (z)	648.4

From the study several conclusions may be drawn:

1. About one-half of the nitrogen in the coal goes into the coke.
2. Of the remainder nearly three-quarters goes into the gas as nitrogen.
3. The total ammonia recovered is only about one-quarter of what it might be if all of the nitrogen in the products of distillation were made into ammonia.
4. Most of the cyanogen goes off with the gas.
5. There is but little cyanogen in any of the liquors or tars, at least in those prior to the secondary condenser.

As for the ammonia, it is clear that a large part of the nitrogen of the coal not only goes to waste, but does actual damage in lowering the calorific value of the gas. It is believed that a method can and will be devised whereby a much larger percentage of the nitrogen will be recovered as ammonia, which will provide needed materials for other manufacture. In conclusion, the author states that no account has been taken of nitrogen in organic combinations other than cyanides. He states that he believes this amount to be too small to be of consequence, but that he will examine into the matter later.

Ingot Defects in Acid Open-Hearth Steel

F. Pacher presents a lengthy review of the problem of sound ingots in *Stahl und Eisen*, 1922, vol. 42, pp. 485-492, 533-540 and 537-577. The sources of defects due to tapping, ingot molds, casting and the character of solidification are enumerated. Some interesting experiments on water and oil mixtures are noted, and certain deductions bearing on the behavior of molten steel and slag are discussed. The respective advantages of top-pouring and of bottom-casting are given: At the moment top-casting is finished, the metal at the top of the mold is the hottest—that circumstance favors the soundness of the ingot. On the other hand, the metal rises more slowly when bottom-casting, and a cleaner skin is generally obtained; these advantages, however, are bought at a price, and the dimensions of the ingots are to be taken into account if they are to be realized.

During the solidification period the steel is subject to dangers arising from uneven temperature conditions and from mechanical forces; thus the quality of the best-melted steel may be seriously impaired. The most serious danger lies in the piping, which is usually accompanied also by axial sponginess and by contraction cavities and cracks. In practice an effort is made to pour at the correct casting temperatures; conditions insuring that temperature will incidentally help to lessen the piping area.

The chemical composition of steel plays an insignificant rôle when compared with changes which result from defects arising during casting and cooling down of the ingot. Therefore every means must be taken to avoid these defects and to obtain sound ingots.

Influence of Phosphorus on Brasses

A. Portevin has discussed this question before the Nancy Congress of the Technical Foundry Association of France. The question having been put to him whether any deleterious effects may result from the presence of phosphorus in cast brasses, two series of alloys with increasing amounts of phosphorus were prepared and tested. In the first series (α brass) the copper content was about 68 per cent, in the second ($\alpha + \beta'$ brass) about 58 per cent. Both sand-cast and chill-cast bars were tested. The results tabulated in the paper show that up to 0.05 per cent phosphorus does not affect the mechanical properties in any considerable degree; on the contrary, if 0.50 per cent is reached, a considerable decrease in resilience and in elongation after rupture occurs.

Microscopical investigations show that phosphorus is responsible for the occurrence of a new constituent, most probably the phosphide Cu_3P. This constituent appears in the first series when the percentage of phosphorus reaches 0.05 per cent, and in the second series after 0.50 per cent. These figures may be taken to represent the solubility of phosphorus.

The velocity of cooling does not seem to affect the rate of separation of the phosphides, neither does it alter the relative amounts of α and β' in the second series of alloys.

It follows that up to the content of 0.05 per cent, phosphorus would not cause any inconvenience in brasses; it will, however, be different with higher amounts.

In his concluding remarks the author draws attention to the fact that phosphorus will not act as a deoxidizer in brasses, as the heat of formation of the oxide of zinc is greater than that of phosphorus, and consequently the former will remain in solution even in the presence of phosphorus. For its elimination more powerful deoxidizers, like magnesium or aluminum, would be needed.

Reclamation of Used Petroleum Lubricating Oils

In Technologic Paper 223 of the U. S. Bureau of Standards, Dr. W. H. Herschel and A. J. H. Anderson describe a series of tests with an apparatus for reclaiming oil which has been subjected to severe conditions of service. By the use of a coagulant it was found that reclaimed oils could be obtained which would stand the usually accepted tests such as viscosity, flash point and sediment, although the flash point was slightly lowered. The authors do not regard the tests as conclusive in regard to the efficiency of the process in reducing the organic acidity, since the oils they used had not been in service long enough to become very acid. The necessity of reducing this acidity to a low value is, however, open to question, since there appears to be no danger that the acidity would ever become high enough to cause corrosion, except perhaps of lead and zinc. The cause of sludge formation in a used lubricating oil is not at all clear, but it appears to differ from an emulsion in requiring considerable time for its development. As an oil continues in use for some time it accumulates dust, carbon and other materials in a finely divided state, and the most probable explanation appeared to be that the sludge is a case of a permanent emulsion due to carbon or dust in a colloidal condition. However this may be, it is evident that all finely divided as well as coarse impurities should be removed from used oils in reclaiming them.

Recent Chemical & Metallurgical Patents

Converting Formates Into Oxalates—According to the invention described in this patent, the formate is converted directly into the oxalate without the addition of any foreign substance, in the presence of air, and by simply and efficiently arranging and controlling the heat zones to which the formate is subjected. The apparatus in which this reaction is carried out provides for passing the formate through a preliminary heating zone by which it is rendered plastic and then subjecting it to heat not greater than 220 deg. C., by which the formate is rendered molten. At this temperature the formate is stable and there is no liability that it will be converted into carbonate. Having slowly raised the temperature of the formate to 220 deg. C., the liquid formate is then suddenly raised to the temperature necessary to drive off its molecule of hydrogen—i.e., to a temperature between 360 deg. C. and 440 deg. C. This is accomplished by spreading the liquid formate thinly over hot surfaces at the requisite temperature. By this means the liquid formate is converted into oxalate almost instantly—that is to say, the conversion does not take more than 2 or 3 seconds. From this brief outline of the process it will be recognized that the quantity of carbonate produced is negligible. The great difficulty heretofore existing in the manufacture of oxalate from formate has been to raise the temperature to the point at which it converts the formate into oxalate so rapidly that carbonate formation will be prevented. (1,445,162; Herman W. Paulus, assignor to Royal Baking Powder Co. Feb. 13, 1923.)

American Patents Issued Feb. 27, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,446,461—Method of and Apparatus for Measuring Gas. Charles W. Hinman, Winchester, Mass.; Nathaniel C. Nash, Jr., executor of said Charles W. Hinman, deceased.

1,446,480—Process and Apparatus for Fume Control. Robert S. Perry, New York, and Paul W. Webster, Pelham Manor, N. Y., assignors to Perry & Webster, Inc., New York.

1,446,546—Method and Apparatus for the Fixation of Nitrogen. Charles H. Buettner, Cincinnati, Ohio.

1,446,550—Process of Removing Impurities From Resorcin. Thurston N. Dissosway, Flatbush, N. Y., assignor to Dissosway Chemical Co., Inc., Brooklyn, N. Y.

1,446,551—Process of Purifying Resorcin. Thurston N. Dissosway, Brooklyn, N. Y., assignor to Dissosway Chemical Co., Brooklyn, N. Y.

1,446,578—Process of Making Sulphates. Harry Pauling, Berlin, Grunewald, Germany.

1,446,606—Process and Apparatus for Extraction of Oils From Vegetable Matter. Matthew Whitehead, Kingston-upon-Hull, England, assigor of one-half to Ernest Scott, Kingston-upon-Hull, England.

1,446,637—Manufacture of Lithopone. Frank G. Breyer, Palmerton, and Clayton W. Farber, Bowmanstown, Pa., assignors to the New Jersey Zinc Co., New York.

1,446,651—Continuous Evaporator for Vegetable and Fruit Pulps. Fernando C. Marzo, Placentia, Calif.

1,446,736—Manufacture of Hydrogen and Oxygen. Farley Granger Clark, Toronto, Ont., Canada.

1,446,737—Treatment of Raw Rubber and Like Plastic Substances. Samuel Cleland Davidson, deceased, late of Belfast, Ireland, Alfred Agar, Holywood, Ireland, and Hugh Taylor Coulter, Belfast, Ireland, executors.

1,446,778—Process for Electrical Precipitation of Suspended Particles From Gases. Gustav A. Witte, Philadelphia, Pa., assignor to International Precipitation Co., Los Angeles, Calif.

1,446,818—Production of Diarylguanideno. John Young, Caldwell, N. J., and Elmer G. Crookman, Buffalo, N. Y., assignors to National Aniline & Chemical Co., Inc., New York.

1,446,844—Drying Kiln. Alexander R. Duff, Toronto, Ont., Canada.

1,446,863—Gypsum Calcining Apparatus. Sheldon E. Townley, East Orange, and Frederick E. Townley, Newark, N. J.

1,446,872—Process of Making Organic Oxides. Benjamin T. Brooks, Bayside, N. Y.; assignor to Chadeloid Chemical Co., a corporation of West Virginia.

1,446,873—Process of Making Chlorhydrins of Organic Liquids. Benjamin T. Brooks, Bayside, N. Y., assignor to Chadeloid Chemical Co., a corporation of West Virginia.

1,446,874—Process of Dehydrating Chlorhydrins. Benjamin T. Brooks, Bayside, N. Y., assignor to Chadeloid Chemical Co., a corporation of West Virginia.

1,446,888—Method of Treating Fibrous Material. Eduard Dyckerhoff, Blumenau, Germany.

1,446,933—Process for the Manufacture of Black Carbonaceous Pigment. Vernon H. Schnee, Ithaca, N. Y.

1,446,953—Process for the Recovery of Tin and Iron Products From Tinned-Iron Waste. Harry V. Welch, Los Angeles, and Walter A. Sheek, Long Beach, Calif., assignors to International Precipitation Co., Los Angeles, Calif.

1,446,984—Method of Revivifying Spent Catalysts and Apparatus Therefor. Thomas Midgley, Jr., Dayton, Ohio, assignor, by mesne assignments, to General Motors Research Corporation, Dayton, Ohio.

1,447,008—Fuel and Method of Producing Same. Lindon W. Bates, Mount Lebanon, N. Y.

1,447,014—Ejecting Apparatus for Exhausting Air or Other Fluids. Raymond N. Ehrhart, Pittsburgh, Pa., assignor to Elliott Co., Pittsburgh, Pa.

1,447,052—Method and Apparatus for Removing Liquid and Salt Deposits From Gas Wells. Michael M. Sweetman, Kansas City, Mo.

1,447,123—Self-Regulating Ammonia-Making Process. Luigi Casale, Rome, Italy, assignor to Casale Ammonia Co., Lugano, Switzerland.

1,447,143—Manufacturing of Lead Alloys. Walther Mathesius, Charlottenburg, Germany.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Preventing Evaporation of Stored Liquids—Among the more important patents affecting the petroleum industry is one recently granted to Frank A. Howard, George H. L. Kent and James M. Jennings, covering the invention of a foam or foam-producing liquid intended to float upon the surface of volatile liquids such as crude petroleum, gasoline and the like, for the purpose of preventing evaporation. The foams described are permanent or stable in character—that is, they do not break down for a considerable storage period. They retain their fluent condition during their entire life, or they may be such as to congeal or solidify at ordinary atmospheric temperatures.

The liquid base for the preparation of a foam in accordance with the present invention may contain from 5 to 15 per cent of water, although preferably between 5 and 8 per cent. From 3 to 10 per cent of glue is incorporated in the liquid together with 5 to 15 per cent of cornstarch or an equivalent starchy material. Glucose or an equivalent material, such as blackstrap molasses, and glycerine are incorporated in the liquid, the combined proportion of these added constituents being from 40 to 80 per cent. From 4 to 8 per cent of calcium chloride is included in the mixture. Apparently this increases its tensile strength at low temperatures. A suitable setting agent, such as ferrous sulphate, is incorporated in the extent of from ½ to 2 per cent. From ½ to 1½ per cent of a suitable foaming agent, such as the sodium salt of sulphonic acids obtained from mineral oil sludge, may be incorporated, together with a suitable preservative as desired.

An example of a suitable foam-forming liquid, prepared in accordance with this patent, would be as follows: glucose, 50 per cent; glycerine, 24 per cent; cornstarch, 10 per cent; calcium chloride, 5.5 per cent; glue, 3 per cent; ferrous sulphate, 0.1 per cent; sulphonic acid salt, 1 per cent, borax, 1 per cent, and water, 5.4 per cent. (1,443,538; assigned to the Standard Development Co. Jan. 30, 1923.)

Nitrocellulose Composition—Hans T. Clarke has discovered that a nitrocellulose composition of desirable properties can be obtained by compounding cellulose nitrate with the salicylates of the higher aliphatic alcohols, such as normal butyl salicylate, amyl salicylate and isobutyl salicylate. The ingredients are combined by the use of a common solvent.

He incorporates in 400 to 600 parts of an acetone and methyl alcohol mixture, 100 parts of nitrocellulose, 20 to 60 parts of fusel oil, normal butyl alcohol or isobutyl alcohol and 1 to 70 parts of normal butyl salicylate. The ingredients are of commercial grades,

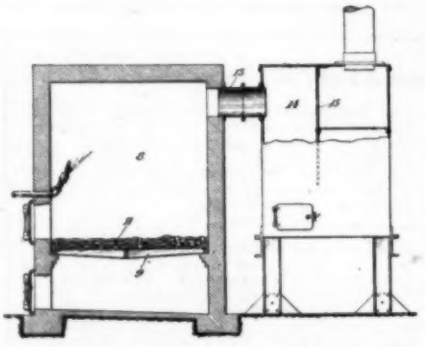
having sufficient purity to provide the necessary transparency and comparative freedom from color required by the finished film. The ingredients are thoroughly mixed and filtered if desired. The film made from this solution still contains the higher alcohols in part with the nitrocellulose and butyl salicylate, and these have the effect of enhancing the stability of the film as well as increasing its flexibility. (1,444,333; assigned to the Eastman Kodak Co. Feb. 6, 1923.)

Cellulose - Ether Composition — In order to provide a solvent which will dissolve such large proportions of cellulose ethers that thick or viscous solutions may be obtained for use in plastic and film-making arts, and also to provide a cellulose-ether solution which may be manufactured into a strong, flexible, transparent film, Stewart J. Carroll has secured a patent for a special combination of solvents. He has discovered that a satisfactory and useful solvent may be prepared by mixing various alcohols with phenyl propyl alcohol. For instance, he combines methyl alcohol, ethyl alcohol, propyl alcohol, isopropyl alcohol, butyl alcohol (normal, iso or secondary) and fusel oil or the amyl alcohols, either singly or in various mixtures, with phenyl propyl alcohol. The proportions may be very greatly varied in a very useful range, from 50 to 10 parts by weight of alcohol mixed with 50 to 90 parts of phenyl propyl alcohol. The patent points out that the phenyl propyl, being of comparatively low volatility, remains in considerable amounts in the film and imparts useful properties to it. (1,444,331; assigned to Eastman Kodak Co. of Rochester, N. Y. Feb. 6, 1923.)

Cellulose-Ether Composition—A patent designed to accomplish somewhat the same object as outlined in the patent just described (1,444,331) has been granted to William R. Webb and assigned to the Eastman Kodak Co. In the process described in this patent a cellulose-ether such as water-insoluble ethyl cellulose is dissolved in a mixture of ethylene chlorhydrin and methyl alcohol or other lower monohydroxy aliphatic alcohol. The proportions recommended are 1 part of ether to 4 to 6 parts of ethylene chlorhydrin. (1,444,406. Feb. 6, 1923.)

Manufacture of Anthraquinone and Phthalic Anhydride—Heretofore one of the principal methods of preparing anthraquinone has been by the high-temperature catalytic air oxidation of anthracene, the anthracene being in more or less high state of purity—that is to say, it contained from 70 to 100 per cent of anthracene. It is now reported that anthraquinone can be produced efficiently from anthracene press cake by the oxidation of the anthracene in the press cake; that phthalic anhydride is produced at the same time by the oxidation of the phenanthrene in the press cake; and that the carbazol present in the press cake may be recovered by prior separation before the substances are passed over the catalyst. Or, if desired, the carbazol may be allowed to remain and a large proportion of it passes over the catalyst unchanged and can be recovered along with the products of oxidation. The catalyst used for this operation consists of vanadic oxide, although oxides of molybdenum or chromium may be employed. (1,444,068. H. D. Gibbs, assignor to E. I. du Pont de Nemours & Co. Feb. 6, 1923.)

Recovery of Potash From Distillery Waste—Carl Haner, Jr., of Baltimore, has assigned to the U. S. Industrial Alcohol Co. a patent for recovery of potash from the distillery waste or slop left after the alcohol has been separated from the alcohol producing material. As indicated in the diagram, the distillery waste is forced through nozzle 1 into the heated chamber 8. The chamber is originally heated by means of a bed of coal labeled 11. Later the process is self-supporting as far as heat is concerned. Potash separates as an



ash from the burning waste and falls to a large extent through the grate bars 9 and is collected in the clean-out pit. The gases pass through pipe 13 into a chamber 14, down which the gases are forced by means of a baffle plate 15. The potash which remains in the flue gases is thus separated out here and cleaned out occasionally through the clean-out doors. It will be noted that the waste is sprayed upward in the combustion chamber and furthermore during the operation the grate bars must be raked with a rabble to facilitate the passage of the potash. (1,444,833. Feb. 13, 1923.)

Refractory—As a lining for heating furnaces in general, and for electric furnaces in particular, Charles A. Scharshu has patented and assigned to the General Electric Co. a refractory consisting of a mixture of crystallized magnesia, calcined magnesia and a carbonaceous binder, heated to from 1,700 to 1,800 deg. C. under conditions permitting elimination from the surface of the carbon residue resulting from decomposition of the binder. The mass is thus converted into a sub-vitreous condition by condensation of sublimed magnesia in intercrystalline spaces.

It is claimed for a refractory lining made in this way that it may be used without appreciable softening at the highest temperatures used in electric steel furnaces and at these temperatures the lining is converted into a mass so hard that it has a metallic ring at operating temperatures. It is also claimed that the lining so made has great resistance to chemical action of slags even at the highest temperatures. This lining is strong mechanically and has not cracked or deteriorated under an almost indefinite number of furnace runs. There is no expansion or contraction at temperatures up to 1,800 deg. C. (1,444,527. Feb. 6, 1923.)

Solidifying Materials—This invention is for the purpose of solidifying various materials, more particularly those which change during the process of manufacture from a viscous condition to a crystalline condition with the evolution of heat. Materials of this kind are combined by boiling the ingredients in a container and the resulting mixture is then permitted to cool. Due to the evolution of heat during the process of crystallization, a great deal of time is necessary for the cooling to take place, and with some mixtures such a high temperature is reached that the mass fuses and becomes difficult to grind. Also, if allowed to solidify in large masses, the material becomes difficult to remove from the containers.

The objects of the present invention are to expedite the crystallization of the material, to enable it to be easily ground, to eliminate much of the work incident to removing the material from the container and generally to simplify the process.

The method employed is as follows: The material while in liquid form is spread in a thin layer on a cooling surface in the form of a drum. It remains on this surface until cool and in a viscous condition. The drum is cooled by the circulation of a cooling medium through its interior. It is revolved by mechanical means and in the course of its revolutions a scraper removes the viscous material from its surface at the desired point. After the material is removed from the cooling drum it is spread out on a traveling belt, on which the crystallization takes place. Since the material is in the form of a thin layer on this belt while the crystallizing process is under way, the heat evolved is readily dissipated, hence shortening the time required for solidification. The conveyor is made sufficiently long for the crystallization to take place completely, and at the end of the conveyor the crystallized material is dumped off into a bin, hopper, car or wherever may be desired. (1,445,004. Edwin Cowles, assignor to the Electric Smelting & Aluminum Co., of Lockport, N. Y. Feb. 13, 1923.)

Pure Liquid Hydrocyanic Acid—W. G. Dingle was awarded patent 1,304,745 dated May 27, 1919, relating to the preparation of crude liquid hydrocyanic acid. The present patent deals with the production of pure liquid hydrocyanic acid. This is accomplished by condensing the gas to liquid form and reconverting it into gas before it is finally condensed. (1,445,303. Feb. 13, 1923.)

British Patents

For complete specifications of any British patent apply to the Superintendent British Patent Office, Southampton Buildings, Chancery Lane, London, England.

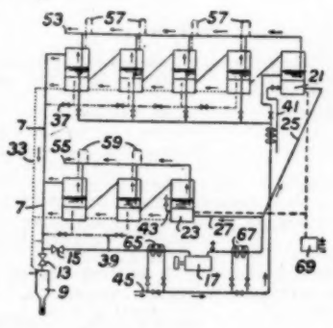
Treating Silicates—Insoluble minerals containing alkali metals, such as feldspar, are heated with fusible salts at a temperature not higher than about 650 deg. C., or less if the heating is effected under pressure. The reaction mixture is extracted with water and the soluble alkali salts separated in known manner. Suitable fusible salts mentioned are the chlorides of calcium, barium, iron, zinc, manganese and aluminum; magnesium sulphate; and barium nitrate. Mixtures of these salts may be employed. In an example, 100 parts of ground feldspar are heated with about 200 parts of calcium chloride at a temperature of 650 deg. C., and the resultant mass extracted. Hydrated calcium chloride may be used if the heating is effected under pressure. (Br. Pat. 188,454. Plauson's, Ltd., London. Dec. 30, 1922.)

Cellulose Ethers—The inventor proposes to reduce the quantity of water present during etherification by addition of dehydrating compounds, in amounts preferably less than half the weight of the cellulose. The amount of caustic alkali or other base used in the etherification is at least equal to and preferably exceeds in the ratio of 3:1 to 19:1 or more the weight of water present or added. By the use of such water-binding agents, the alkali is more firmly seated on or united to the cellulose, and the etherification may be carried out with reduced quantities, even down to theoretical quantities, of alkali and etherifying agent. Suitable water-binding agents are the oxides of the alkali and alkaline earth metals, the hydrides of calcium and magnesium, the metals calcium, barium and sodium, and sodamide and sodium ethylate powder.

The compounds formed by the union of the water-binding agent with the water present may constitute in part or wholly the alkali or base necessary for the etherification; the hydroxides of the alkaline earth metals may be employed as the base, but with these, being weaker, the etherification may be conducted at temperatures higher than those necessary with the caustic alkalis.

In order better to control the temperature during the removal of the water, the water-binding agents are preferably incorporated in the presence of diluents or solvents such as benzol, toluol, carbon tetrachloride, ether, ligroin or benzene, and the mixture is strongly cooled; the solvents or diluents may also be employed during the etherification. The initial material is either cellulose or a near conversion product insoluble in dilute alkali at ordinary temperatures, or alkali-soluble cellulose derivatives from which such alkali-insoluble cellulose or conversion products may be reconstituted, or such reconstituted products themselves. In examples, cellulose impregnated with water is kneaded with sodium oxide either alone or with an addition of caustic soda and preferably in the presence of a diluent such as benzol, while cooling strongly, and to the mass which contains either no water or a very reduced quantity, diethyl sulphate is added, the temperature being maintained at 60 to 80 deg. C., or even at ordinary temperature or lower; instead of diethyl sulphate the corresponding methyl ester may be used, the temperature in this instance being maintained at 0 deg. C. or lower, for example, at —5 to —10 deg. C.; cellulose impregnated with water and caustic soda is kneaded with calcium oxide, preferably in the presence of benzol, etc., while strongly cooling, and the etherification is effected by the addition of diethyl sulphate with or without the addition of a further quantity of solid caustic soda, the temperature in this instance being between 60 and 130 deg. C. Alternatively, the water-binding agents may be added partly or entirely during the etherification. Specifications 12854/12 and 6035/13 are referred to. (Br. Pat. 187,639. H. Dreyfus, London. Dec. 20, 1922.)

Evaporating Liquids—Relates to multiple-effect apparatus in which vapor from the final effect, or from one of the final effects, is compressed and used as heating medium in the first effect or one of the first effects. The



energy required for the compression is derived from a natural direct source of mechanical energy, such as a fall of water, and heat losses are made up by steam from an electrically heated boiler, the energy for which is derived from the same source. The ordinary steam supply and condensing arrangements are retained in order that the amount of evaporation effected by the steam and by the energy of compression may be varied. Liquid is added to the vapors before or after compression, so as to absorb the superheat and generate makeup vapors. As applied to the apparatus described in specification 187,260, in which a number of multiple-effect plants with overlapping temperature ranges are used and in which the final effects of each plant are connected to a main 7 which leads by a valve 13 to a condenser 9, a branch pipe provided with a valve 15 leads to a compressor 17, the compressed vapors being led by pipes 25, 27 to the heating spaces 21, 23 of the first effects of each plant. The condensates from each effect are cooled by flashing off vapor into effects at lower pressures and pass by a main 33 to the condenser 9. The liquid to be evaporated fed through a pipe 45 may be preheated in coils 65, 67 by the vapor before or after compression and by non-condensible gases withdrawn from the heating spaces of the first effects of each plant by valved pipes 41, 43. Non-condensible gases from the later effects are withdrawn by pipes 37, 39 leading to the main 7. The liquid to be evaporated is fed in parallel to the effects of each plant and the concentrated liquid is withdrawn in parallel through pipes 53, 55, vapors being flashed off to cool the liquid by connections 57, 59 to effects at lower pressures. Steam may be supplied to the heating spaces of the first effects from an electrically heated boiler 69. (Br. Pat. 188,703. T. Rigby, Westminster. Jan. 10, 1923.)

Preventing Incrustation and Corrosion—To prevent or reduce the corrosive or fouling action of water on the walls of a boiler or on brass, copper, tin, rubber, glass, earthenware and the like, a mixture of one or more soluble chlorides and one or more soluble chromates or bichromates is added to the water. Sodium, potassium, ammonium or zinc chromate is preferably used. (Br. Pat. 188,778. E. R. Jones and W. S. Smith, Westminster. Jan. 10, 1923.)

Ferric Oxide Absorbent Gel—Ferric oxide is prepared in a form suitable for use in the absorption or adsorption of condensible gases and vapors. A ferric hydroxide gel precipitated from a ferric salt solution is washed, filtered, pressed and dried slowly, first at a moderate temperature and then at a higher temperature. The hydroxide gel is preferably precipitated from a concentrated ferric salt solution by means of a dilute caustic alkali or alkali-carbonate solution, the precipitant being slowly added to the ferric salt solution, with agitation, until a thick paste is obtained. The precipitate is washed with water containing small amounts of dissolved matter, filtered and pressed into slabs or extruded through holes in a die. The first drying is effected slowly at a temperature of 26 to 36 deg. C., a hard brittle product being obtained. The second drying is accomplished either in a current of air at a temperature of 110 to 160 deg. C., or in a vacuum, in which case the temperature is preferably raised slowly from 100 to 160 deg. C. and may afterward be slowly increased to 250 deg. C. (Br. Pat. 188,786. B. Lambert, Oxford. Jan. 10, 1923.)

Phenylglycine—Phenylglycine is obtained from trichlorethylene and aniline by a modification of the process of specification 173,540. One molecular proportion of trichlorethylene is slowly pumped into a mixture of slightly more than one molecular proportion of aniline and a base such as milk of lime at 170 to 180 deg. C. An example of the method is given, the phenylglycine salt obtained being worked up in the usual manner. (Br. Pat. 188,933. British Dyestuffs Corp., Ltd., and M. Wyler, of Blackley, Manchester. Jan. 10, 1923.)

Technical News of the Week

Current Events in the Chemical, Metallurgical and Allied Industrial Fields
Legislative Developments—Activities of Government Bureaus, Technical Societies and Trade Associations

World Petroleum Output Shows Increase in 1922

American Petroleum Institute Estimates 11 Per Cent More Production Than in Previous Year

Mexican Official Figures Show Drop

THE American Petroleum Institute estimates the world's petroleum production in 1922 at 851,540,000 bbl., compared with 765,065,000 bbl. reported by the U. S. Geological Survey for 1921. The increase in 1922 amounted to 84,475,000 bbl., or 11.3 per cent.

The United States produced 551,197,000 bbl. in 1922, or 64.7 per cent of the total world production. In 1921 the United States produced 472,183,000 bbl., or 61.7 per cent of the world production in that year. The increase in the United States production in 1922 amounted to 79,014,000 bbl., or 16.7 per cent. Mexico produced 185,057,000 bbl. in 1922, amounting to 21.7 per cent of the world production. In 1921 Mexico produced 193,397,587 bbl., or 25.3 per cent of the total production that year. The decrease for Mexico in 1922 amounted to 8,340,587 bbl., or 4.3 per cent. In 1922 the United States and Mexico combined produced 86.4 per cent of the world production and in 1921 87.0 per cent. Substantial increases in production in 1922 are shown by Persia, Peru, Sarawak, Argentina and Venezuela, while Colombia showed its first commercial production.

Wherever possible 1922 production figures are official final figures or official estimates. In converting the figures of certain countries from tons to barrels, equivalents are stated in United States barrels of 42 gal., based upon the average specific gravity of the oil of each country. All the figures shown for 1921 are those reported by the U. S. Geological Survey.

The Institute estimates that the daily average gross crude oil production in the United States for the week ended March 3 was 1,795,400 bbl., as compared with 1,784,700 bbl. for the preceding week, an increase of 10,700 bbl. The daily average production east of the Rocky Mountains was 1,165,400 bbl., as compared with 1,154,700 bbl., an increase of 10,700 bbl. California production was 630,000 bbl., the same as the previous week.

The following are estimates of daily average gross production for the weeks ended March 3, Feb. 24, 1923, and March 4, 1922:

Estimated World Petroleum Production

	1922, Bbl.	*1921, Bbl.
United States	551,197,000	472,183,000
Mexico	185,057,000	193,397,587
Russia	35,091,000	29,150,000
Persia	21,154,000	16,672,540
Dutch East Indies	16,000,000	16,958,105
Roumania	9,817,000	8,368,000
India	7,980,000	8,000,000
Peru	5,332,000	3,699,280
Poland (Galicia)	5,110,000	5,167,000
Sarawak	2,915,000	1,411,000
Argentina	2,674,000	1,747,410
Trinidad	2,445,000	2,354,000
Venezuela	2,335,000	1,433,000
Japan and Formosa	2,004,000	2,447,000
Egypt	1,188,000	1,255,000
France	494,000	392,000
Colombia	323,000	.....
Germany	200,000	200,000
Canada	179,000	190,338
Italy	31,000	34,400
Algeria	9,000	2,688
Others	5,000	2,652
Total	851,540,000	765,065,000

* Figures for 1921 are those of the U. S. Geological Survey.

Calendar

The following important technical meetings are scheduled for the immediate future:

AMERICAN CHEMICAL SOCIETY
New Haven, Conn., April 3-7

AMERICAN FOUNDRYMEN'S ASSOCIATION
Cleveland, O., April 28-May 4

AMERICAN OIL CHEMISTS' SOCIETY
Hot Springs, Ark., April 30-May 1

SOCIETY OF INDUSTRIAL ENGINEERS
Cincinnati, O, April 18-20

SOCIETY OF CHEMICAL INDUSTRY
New York, regular meeting, March 23

SOCIETY OF CHEMICAL INDUSTRY
New York, joint meeting with other societies, April 20

The total production of petroleum in Mexico during the year 1922 was 185,057,249 bbl., a decrease of 9,698,463 bbl. from the previous year, when the total production was 194,755,712 bbl., according to figures compiled by the Mexican Service Bureau from the official documents of the Secretaria de Hacienda y Credito Publico.

Of the total 46,763,959 bbl. was produced in the Tampico district, an increase of 4,653,302 bbl. over the previous year, and 138,280,924 bbl. in the Tuxpam district, a decrease of 14,362,098 bbl. from the previous year. In addition to these two fields, the Mexican Eagle produced 12,366 bbl. in the Isthmus. The production of the Tuxpam-Isthmus zones is light oil and that of Tampico is heavy oil, with the exception of 1,450,279 bbl. of heavy oil produced in the Tuxpam district by well No. 2, Molino, of the Penn-Mex. Fuel Co. and wells Nos. 2 and 6, San Gerenimo, of the Mexican Eagle.

The largest producer was the Huasteca Petroleum Co., with 55,604,871 bbl., all of which was light oil and represents 30 per cent of the entire Mexican production. This is an increase of 26,140,165 bbl. over the previous year, or 88.7 per cent (in addition the Mexican de Pretroleo, South America, another subsidiary of this company, produced 1,833,554 bbl. of heavy oil). This is a remarkable showing in view of the fact that the entire production was in the south fields, where there has been a considerable amount of salt water invasion.

The exports from Mexico for the year 1922 were 180,872,239 bbl., an increase of 8,557,907 bbl. over the previous year, when 172,304,332 bbl. was exported. This increase of exports was due in a large measure to the increased production of Huasteca Petroleum Co. and the drawing of oil from storage by the other companies. The largest exporter was the Huasteca Petroleum Co., with 39,508,879 bbl., which consisted mainly of 32,315,793 bbl. of fuel oil and 5,892,654 bbl. of crude gasoline.

Daily Average Production
(Figures in Barrels)

	1923 Mar. 3	1923 Feb. 24	Difference	1922 Mar. 4
Oklahoma	414,400	406,550	Inc. 7,850	345,500
Kansas	80,600	80,950	Dec. 350	82,000
North Texas	51,100	50,250	Inc. 850	50,850
Central Texas	120,550	124,050	Dec. 3,500	205,150
North Louisiana	71,300	70,750	Inc. 550	116,500
Arkansas	105,600	103,750	Inc. 1,850	34,300
Gulf Coast	104,450	106,450	Dec. 2,000	107,950
Eastern	108,000	107,000	Inc. 1,000	110,000
Wyoming and Montana	109,400	104,950	Inc. 4,450	57,800
California	630,000	630,000	.....	310,000
*Total	1,795,400	1,784,700	Inc. 10,700	1,420,050

* Daily average production.

S.O.C.M.A. Annual Meeting Hears Herty and Garvan

Speakers Analyze Situation and Outline Future Plans—Need of Co-operation Is Keynote of Meeting

PAST progress and future plans largely featured the address of Dr. C. H. Herty at the annual meeting of the Synthetic Organic Chemical Manufacturers held March 7 at the Hotel Pennsylvania, New York City.

F. P. Garvan also spoke, bringing out many points of interest both to manufacturers and to the public. He emphasized the absolute necessity of co-operation if the American dye industry is to progress. Education of the people to the menace of foreign monopoly was also stressed as an essential to a healthy state of the American industry.

Dr. Herty's remarks, broad in scope, threw much light on the situation and upon the activities of the association, which he outlined from the trials and triumphs of the past year to the plans for the coming year. Dr. Herty opened his remarks by saying:

"The constitutional year just ending may well be designated one of the most remarkable periods through which any branch of industry has passed. Faced at the outset with a Congressional investigation, avowedly proposed with hostile intent; engaged for months in a struggle for legislation assuredly protective against a vicious foreign competition; shaken for a while to its very roots by an unexpected governmental attack upon the governmental authorized holding of important patents; bearing throughout this period the brunt of a general industrial depression; surely these have been times to try men's souls. And yet at the close of the year we find the clouds dispersed, our industry enjoying a far larger measure of sympathetic public understanding, constantly increasing cordial relations between producers and consumers, ample contentment with the quality and price of our products and consequent placing of orders which insure prosperous times ahead."

Public Support Gaining

The problem of molding intelligent public opinion, of showing the public the real nature and significance of the dyestuff industry, is difficult but not impossible. Dr. Herty cited the public support which is being given to the industry by the medical profession, which is coming to realize the importance of the industry to the public health of the nation. The work of the Chemical Foundation in regard to fostering public opinion of the right sort by showing the vital importance of chemistry to every line of human endeavor was highly praised.

In commenting upon relations with Germany, he spoke of the protest offered by the association against the revival of the patent convention of 1909. The matter is still unsettled and is likely to become an issue of decided importance. Co-operation with the U. S. Army in the study of war essentials and the advance of public welfare through doing away with stream and air polution also were discussed.

Commercial development, especially through the assistance of information furnished by government bureaus, was urged as an indication of progress.

President Herty said in conclusion:

Portentous Changes Imminent

"As we begin this second year of our association's existence, portentous changes seem imminent in world conditions of the chemical industry. No one can predict what may result from the occupation of the Ruhr and from the dislocation of normal business activity in all parts of the occupied area in Germany. Official statements of the Department of Commerce make clear that already prompt forwarding of exports is being seriously hampered; doubtless the embargo on shipments from the Ruhr to others parts of Germany will soon make its demoralizing influence felt in a shortage of crudes and intermediates.

"The nation which purposely inflated its currency, partly for the sake of regaining control in foreign markets, is now paying the price of such debauchery. Whatever the outcome, the fact is once again brought home closely that as to the products of our industry America must make itself forever independent. Therefore upon us is laid afresh the responsibility of seeing that this independence is gained.

"How can it be done? The industry must seriously set about the task of expanding our lines of products as quickly as possible, so that no consumer may feel the need of looking beyond our shores to cover fully his every need. To do this the research chemist must be given fullest opportunity to lead the way, the best of engineering talent must be employed to translate effectively the results of laboratory research into terms of highest efficiency in plant operations, and financing must be sound.

"It is no inviting field into which novices may rush, but the experience gained during the past 5 years must be utilized to the maximum. The daily evidences of how brilliantly that experience has been achieved gives full conviction that the task will be fully met. It is an inspiring thought that over and above the normal satisfaction arising from work well done and reasonable profits justly earned there stands the loftier feeling that through the success of our efforts we are contributing directly to the security of the nation, the health of our people and the economic independence of our country."

A sidelight showing the consumer's growing interest in American chemical industry appears in a letter written by John P. Wood, president of the American Woolen Association, to Dr. C. H. Herty, in which he writes:

"It would have given me a great deal of pleasure, for myself and on behalf of those whom I represent, to renew the assurance so often given in the past of our very sincere and earnest desire for the prosperity and for the most complete and successful development of the American dye and chemical industries."

Officers of the Association

The board of governors of the Synthetic Organic Chemical Manufacturers Association of the United States elected for the coming year are: President, Charles H. Herty; treasurer, F. P. Summers, Noil Chemical & Color Works, New York City.

Dyestuffs Section—F. E. Signer, vice-president Butterworth-Judson Corporation, New York City; August Merz, Heller & Merz Co., Newark, N. J.; C. N. Turner, Newport Chemical Works, Passaic, N. J.; F. P. Summers, Noil Chemical & Color Works, New York City; George H. Whaley, John Campbell & Co., New York City.

Crudes and Intermediates Section—F. W. Pickard, vice-president E. I. du Pont de Nemours & Co., Wilmington, Del.; S. W. Wilder, Merrimac Chemical Co., Boston, Mass.; R. N. Wallach, Grasselli Chemical Co., New York City; William S. Weeks, Calco Chemical Co., Bound Brook, N. J.

Fine Organic & Medicinal Chemicals Section—A. S. Burdick, vice-president Abbott Laboratories, Chicago, Ill.; Herman Seydel, Seydel Chemical Co., New York City; G. F. Richmond, Antoine Chiris Co., New York City.

Boll Weevil Campaign Elects Officers

Organized activity is well under way at the headquarters of the National Campaign for Boll Weevil Control. Dr. Miller Reese Hutchison, president and general manager, whose position in regard to the American Cotton Association is clear since he has definitely announced his severance of all connection with the same, is drawing men of prominence into the new organization. These appointments include Frank S. Bragg, vice-president Union & Planters' Bank & Trust Co., Memphis, Tenn., treasurer; general counsel, John D. Martin, Memphis, Tenn.; secretary, A. B. Meserlin, New York; assistant treasurer, Floyd Swift, Union & Planters' Bank & Trust Co., Memphis, Tenn.; assistant secretary, M. V. Birney, New York.

Australian Sulphur Duty Favors Britain

The Australian Government has decided to allow the importation of sulphur for use in the manufacture of superphosphates free of duty from Great Britain. Sulphur from other countries will be subject to a duty of 10 per cent.

A.E.S.C. to Standardize Scientific Symbols

Conference Reveals Strong Sentiment for Unified Technical Abbreviations—Foreign Help Sought

A recent conference held in New York City under the auspices of the American Engineering Standards Committee revealed a sentiment among engineers, scientists, government officials, business paper editors and industrial executives in favor of the unification of technical and scientific abbreviations and symbols.

It was agreed that the standardization of abbreviations and symbols would result in decided mental economies. The present situation with respect to the use of abbreviations and symbols in engineering, scientific and other technical fields is comparable to a language which has degenerated into a multiplicity of dialects, each of which has to be translated for the users of the others. Abbreviations and symbols constitute an ever-growing and important part of the language of engineers, scientists, industrial editors and other technical men. The use of one symbol or abbreviation for several different terms and the use of several different symbols or abbreviations for one meaning are, however, at present causing a great deal of confusion, misunderstanding and often serious errors.

Foreigners to Co-operate

The conference was called upon requests from the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Association of Edison Illuminating Companies, to consider abbreviations and symbols, but after some discussion of the subject it was thought desirable to include as a part of the project the graphical symbols which are used in engineering drawings, diagrams and the like for representing instruments and apparatus and components of them.

It was agreed that the co-operation of foreign standardizing bodies should be sought in the development of the work. The importance of international uniformity in symbols is great on account of the international character of much engineering and scientific work, and the importance of reference books and periodicals in foreign languages.

The work will go forward under a committee organization developed in accordance with the rules and procedure of the A.E.S.C.

Congress Starts Metal Inquiry

The gold and silver industries are to be investigated during the Congressional recess. Miners, smelters and railway executives are to be called to Washington to confer with the commission conducting the inquiry. The object of the investigation is to locate the causes of the depressed condition of the industry, including the production, marketing, transportation, sale and uses of gold and silver. Also the effect of decreased production upon commerce, industry, exchange and prices will be looked into.

Tariff Board Splits on Flexible Plan

The Tariff Commission has split on the question of the general policy to be followed in administering the elastic provisions of the new tariff law, and the differences of opinion have been put before President Harding for decision. Upon his return from Florida the President is expected to determine the general line of activity to be carried on by the commission.

Meanwhile the commission has decided to proceed with the investigation of the cost of production of twenty-five or thirty commodities, which have been made the subject of complaints, calling for an equalization of costs through the elevation or reduction of customs duties. The list of these commodities will be announced shortly.

Plans for Procedure

Field investigations into the costs of production of the chosen commodities, which include chemicals and textiles, will be made and public hearings are to be held. It is stated by the commission that it will be 2 months or so before sufficient information has been gathered to warrant commencement of the hearings.

The Tariff Commission is enlarging its staff for this work and announces appointment of a chief and an assistant economist. Dr. John R. Turner, dean of the Washington Square College of New York University, has been appointed chief economist of the Tariff Commission.

Dr. A. L. Faubell, also of the Washington Square College, was named as assistant chief economist. Their university duties, it is said, will require their attention until May 15, after which date they will assume their new posts with the Tariff Commission.

Reforestation for Paper Pulp Industries

Paper Makers' Interest in Timber Growth Increases—Many Firms to Aid Work

As a result of the increasing scarcity of natural forest acreage available for exploitation by paper pulp interests, the manufacturers in this line are more and more turning their attention to reforestation of cut-over lands.

In this connection, the Chateaugay Pulp & Paper Co., Chateaugay, N. Y., has recently arranged with the New York State Department of Conservation for the planting of 150,000 Norway spruce trees for artificial reforestation for paper pulp supply. The Bogalusa Paper Co., Bogalusa, La., has transferred to the state for technical forest management a total of 53,000 acres of land. It is proposed to co-operate with the state for the scientific growth of timber to insure permanent raw material supply for the local mills. The Mead Pulp & Paper Co., Dayton, Ohio, has been conducting a series of experiments in the Ohio Valley district for reforestation with woods adaptable to pulp production, and plans to develop a large mileage for this purpose.

In Maine, three paper companies are now giving active attention to future raw material source, utilizing spruce as well as pine. The Eastern Manufacturing Co., Bangor, is giving over land for this development, as are the Orono Pulp & Paper Co., Orono, and the Pejepscot Paper Co., Brunswick.

The Canadian Department of Forestry is working with the Price Brothers Co., Quebec, for the reforestation of land for mills of this organization. So far, 900 square miles has been turned over to the department for a pulp wood forest.

Tariff Commission Studies Foreign Discrimination

Unfair Treatment of U. S. Products Causes Complaints—Cottonseed Oil a Case in Point

THE retaliatory provisions of the new tariff bill may be invoked if the present investigations of the Tariff Commission confirm the numerous complaints of discrimination against American commodities by foreign countries.

The commission expects to complete its study of these complaints shortly. If the State Department agrees to the procedure initial steps in retaliation will then be taken. This will be difficult, according to the commission, because much of the discrimination is under the cloak of most favored nation clauses of commercial treaties.

Cottonseed Oil Case

Italian imports of American cottonseed oil are an example. Italy has a most favored nation clause in its commercial treaty with the United States, but at the same time imposes a higher duty upon cottonseed oil than upon other oils usable for similar purposes. While the duty so imposed would apply equally to other nations, the fact remains that nearly all of the cottonseed oil originates in this country and the high customs rate on the commodity in comparison with other oils is considered as in effect a discrimination.

Other countries against which complaints of discrimination have been brought are Canada and Finland. Canada has a preferential tariff agreement with Great Britain and in addition agreements with France and Japan which are complained of as operating in discrimination of this country's products. American automobile manufacturers complain that French cars enjoy a 30 per cent advantage compared with their product on entering Finland.

Iota Sigma Pi of Yale Invites Women Chemists

The Yale Chapter of Iota Sigma Pi, national honorary society for women in chemistry, announces that it extends a cordial invitation to all women in any branch of chemistry to attend the meeting of the American Chemical Society at New Haven, April 2 to 7. A special program is being arranged by the young ladies in the departments of chemistry and physiological chemistry in the Graduate School of Yale, and they also expect to take care of the entertainment of visiting women chemists.

Iota Sigma Pi is represented by active chapters in a number of the leading universities of the country and is proving a very valuable means of encouraging interest in the subject, especially in graduate work. The requirements for membership are a completion of forty year-hours of chemistry with a grade of B, but the major portion of the membership is composed of graduate students and women actively engaged in chemistry. Mme. Curie is one of the honorary members of the organization.

Announcement will be made later of the special features of the program concerning this organization and the name of the speaker, a noted woman chemist, who will deliver a special address some time during the A.C.S. meeting.

Hafnium Samples Coming to America

The first definite information upon the discovery of hafnium is contained in a letter from Dr. G. Hevesy of Copenhagen, the discoverer, to Dr. George F. Kunz, president of the New York Mineralogical Club. Dr. Hevesy wrote as follows:

"We investigated a great number of zirconium minerals from all parts of the world, and we found in all these specimens 5 to 10 per cent of hafnium. Taking into account Clark's estimate of the zirconium content of the earth-crust (0.018 per cent), our estimate of the hafnium content of the earthcrust, one to one hundred thousand, is certainly not too high. All commercial preparations of pure zirconium contain 1 to 5 per cent of hafnium."

Dr. Kunz's Opinion

Dr. Kunz, in commenting upon the discovery, said:

"We are awaiting with the greatest interest more detailed information regarding the special properties of this element. It is too early to say what commercial value it will have or what use will be made of it, but the discovery of new fundamental elements is so rare that this in itself is noteworthy. It may even exist in greater quantities than these two eminent scientists believe."

Zirconium, from which the element was extracted, is in free commercial distribution, and is used in the manufacture of refractive substances.

Match Manufacturers Form Merger

Corporation Perfected to Meet Competition of Powerful Companies Will Be Third Largest of Its Kind

A merger of nine of the small match companies of the United States has been formed under the name of the Federal Match Corporation in order to obtain collectively the strength needed to compete with the larger companies in the field.

The consolidation of these companies represents about 20 per cent of the business of the country, and will result in economies through centralized management, purchasing, reduced freight costs and sales expense.

Companies Forming Merger

The companies forming the Federal Match Corporation are: Fred Fear, Bloomsburg, Pa.; the Pennsylvania Match Co., Bellefonte, Pa.; Union Match Co., Duluth, Minn.; Reliable Match Co., Ashland, Ohio; Indiana Match Co., Crawfordsville, Ind.; National Match Co., Joliet, Ill.; Wheeling Match Co., Wheeling, W. Va.; Cleveland Match Co., Cleveland, Ohio, and Minnesota Match Co., Duluth, Minn.

The total net assets of the companies are about $5,000,000, and the authorized capital stock of the newly formed Delaware corporation is $6,000,000. Preferred stock, of which about $5.000,000 is to cover the net assets of the corporation, will be issued. It is not planned to offer any of the stock issued to the public. Heavy timber purchases and operation of block plants are features in the plan to meet the competition of large companies already in the field.

Mines Bureau Expands

To provide for the additional duties which have been entrusted to the Bureau of Mines by the Congress and by the Secretary of the Interior, Director Bain has announced an organization change creating a leasing branch of the bureau. The new branch is to be under the immediate supervision of A. W. Ambrose, the assistant director, who also will act as consulting engineer to all branches of the bureau on matters relating to petroleum and natural gas.

The name of the investigations branch of the bureau is changed to research branch. Dorsey A. Lyon, the chief metallurgist of the bureau, has been placed in charge of the research branch with the title of assistant director. As assistant director, he will continue to perform the duties of supervisor of the bureau's experiment stations.

F. J. Bailey, as assistant to the director, will be in charge of the operations branch of the bureau. T. T. Read has been appointed supervising mining engineer. C. E. Julihn will succeed him as chief of the information service. Francis Winslow will succeed Mr. Julihn as chief mining engineer of the War Minerals Relief Commission.

Mammoth Oil Well Found in Venezuela

The recent bringing in of one of the largest oil wells the world has ever known, with a daily production of more than 100,000 bbl., has greatly stimulated interest in oil development in Venezuela, where a number of American and British companies are in lively competition with one another to open up promising fields in which they have secured concessions.

Many of the concessions which these companies have obtained date back to the days of former President Castro, while a few run back into the last century. The present Venezuelan Government, however, is respecting all these concessions, no matter when acquired, and concerns which are operating under them are doing so without any trouble, according to advices received here.

Among the British companies operating are the Venezuelan Oil Concession, the Colon Development Co., the British Controlled Oil Fields, Inc., the North Venezuelan Co., and the Caribbean Petroleum Co.

Air Reduction Enters the Cyanide Field

It has been recently announced that the Air Reduction Co., Inc., of New York has joined with Los Angeles capitalists in the formation of a company to be known as the California Cyanide Co. to engage in the manufacture of liquid hydrocyanic, sodium cyanide and kindred products. The Air Reduction Co. itself is one of the two largest producers of oxygen, nitrogen, acetylene and oxyacetylene and welding apparatus in the United States. Among its directors are P. A. Rockefeller, Robert W. Goelet, Samuel F. Pryor, Guy Cary, Frederick B. Adams, John McHugh and Frederick W. Allen, of Lee, Higginson & Co.

A Million Dollar Concern

The interests in southern California which have joined with the Air Reduction Co., Inc., are headed by F. W. Braun, of Los Angeles, long known as a pioneer in the application and use of liquid hydrocyanic in citrus fruit tree fumigation, as well as in the use and application of sodium cyanide in mining operations. Mr. Braun has accepted the presidency of the California Cyanide Co. Steps have been taken by the two groups involved to raise more than a million dollars for working capital for the new company, and work on a new plant will be started immediately.

A ten-acre tract on Boyle Avenue may be selected as the site for the plant. Associated with Mr. Braun in executive and directorate capacities in the new corporation are John Pike, vice-president; J. D. Neuls, in charge of field work; R. W. Poindexter, in charge of laboratory and research work; H. W. O'Melveny, S. F. Pryor, L. F. Loree and C. C. Adams, directors.

Commerce Department to Amplify Coal-Tar Reports

While the February report of the Department of Commerce giving in detail imports of coal-tar dyes at New York during that month was an improvement over the first report of this character, that for January, in that it showed the quantity proportion of each shipment by country of origin, it has been announced that an effort will be made to amplify these statistics further hereafter. The future amplification will not be in the direction of further information regarding dye imports, it is said, but will be an effort to add statistics of other coal-tar products.

The importance of giving information of imports of coal-tar intermediates, as well as finished products, has been recognized and it is probable that the first extension of the service will be inclusion of intermediates in the monthly reports. Some of the intermediates are imported in a condition so nearly finished that without information of the volume of such receipts domestic producers do not have the full picture. It is known, for instance, that considerable indoxyl is coming into the country, about 95 per cent completed for indigo and requiring only a little air until finished.

Later, if the finances of the statistical department will stand the strain, it is hoped by the chemical division of the Department of Commerce to add coal-tar chemicals other than dyes and also synthetic organic chemicals from other than a coal-tar base.

Navy Department to Have Helium Plant

The Navy Department has requested the Bureau of Mines to design and install a plant at the Lakehurst flying field for the repurification of helium. The plant is to have a capacity of 10,000 cu.ft. of helium per hour. It will combine high-pressure purification and charcoal purification at low temperatures. The high-pressure cycle will step up the helium from 85 to 94 per cent. The charcoal will boost it from that point to practically 100 per cent. The plant will be completed this fall. The design of the new plant is being made by Dr. R. B. Moore, the bureau's chief chemist.

Naval Stores Export Corporation Requests Charter

Rosin and turpentine of all kinds will be exported by the Naval Stores Export Corporation of New Orleans if the papers which have been filed with the Federal Trade Commission meet with approval. The corporation would include in its organization about twenty firms doing business at present in Florida, Louisiana and Alabama. At the present time the United States produces about 75 per cent of the world's total supply of naval stores, of which more than half is exported. In 1921 the value of our exports of these commodities was over $11,000,000.

Limits Alsace Potash Exportation

French Bill Leases Mines for 75 Years and Outlines Plan of Distribution

No potash in the future will be exported from Alsace until French requirements have been met. This is in accordance with a bill recently passed by the Chamber of Deputies, which acts as a pendant to that recently voted ratifying the agreement with the Badische Anilin and Soda Fabrik, whereby the Alsace mines are to be leased for 75 years. Both bills provide for the production of fertilizers essential to agriculture by companies organized on national lines and working on the co-operative principle. It is estimated that the Alsace mines should produce a quarter million tons of potash annually.

Bureaus Co-operate to Study Corrosion

To avoid any duplication of work, a co-operative arrangement has been completed between the Bureau of Mines and the Bureau of Standards for the handling of studies being made of corrosion. The work is confined mainly to the corrosion problem as it affects metals and alloys exposed to mine waters.

Despite the fact that corrosion has been one of the most active deteriorating agents throughout the entire history of the use of metals, the factors underlying the phenomena of corrosion are little understood. It is with the idea of illuminating this subject that the Bureau of Mines and the Bureau of Standards are contemplating more active work on it. Considerable progress already has been made, particularly in the devising of methods whereby corrosion can be brought about quickly in the laboratory to an extent which would require years of exposure under ordinary conditions.

Professor Paterno Honored

The Italian Association of General and Applied Chemistry has appointed a committee under the presidency of P. Ginori Conti, to arrange a celebration in honor of the seventy-fifth anniversary of Professor and Senator E. Paterno.

As a permanent memorial of the occasion, the committee has decided to establish a memorial fund for the "Paterno medal," which will be conferred annually upon the author of the most important contribution to chemistry, regardless of his nationality.

In order that the endowment of this medal may be given an international character, the committee welcomes contributions from the chemists of the world in support of the medal. Subscriptions from American chemists may be forwarded to the Division of Chemistry and Chemical Technology of the National Research Council, Washington, D. C., for transmission to the Italian committee.

Fertilizer Monopoly Seen by Trade Commission

The mixed fertilizer business in the United States is increasingly passing into the control of seven large companies and their subsidiaries, the Federal Trade Commission reported to the Senate March 3 in response to the Norris resolution for information. The report indicated a tendency toward price control through uniform contracts making dealers virtually agents.

Co-operative buying by farmers was described as the most important factor in lowering the price. The American Agricultural Chemical Co. dominates the fertilizer situation in the North and the Virginia-Carolina Chemical Co. in the South, according to the report. Their combined output is about one-third of the country's total. These two companies, with the International Agricultural Corporation, the F. S. Royster Guana Co., the Armour Fertilizer Works, Swift & Co. and the Baugh companies and subsidiaries, produced 65 per cent of the commercial fertilizer in 1921, compared with 58 per cent in 1916.

Oil Leases Denied to Aliens

The decision of the Interior Department holding that companies in which aliens have a controlling interest cannot obtain leases of American oil lands was reaffirmed in a decision announced March 6 in the case of the Roxana Petroleum Corporation. Approval of the decision was said to be the last official act of Secretary Fall before he retired from office.

The policy of the government regarding alien control of domestic oil supplies was announced in 1922, but had never been tested until the Roxana company appealed from the department regulation which prevented it from carrying out operations designed to take over extensive lands held by the Creek tribe in Oklahoma. In the hearing granted the company by the Interior Department, it was developed that although it was a domestic corporation, more than 65 per cent of its stock was owned by Dutch and British interests.

Potters Plan Convention

The annual meeting of the United States Potters' Association, postponed from December last, will be held at the Hotel Astor, New York, April 10-12. A feature of the meeting will be a report of the research committee of the organization, of which A. V. Bleininger, Homer Laughlin China Co., Newell, W. Va., is chairman. It is expected that President Frank P. Judge, National China Co., Salineville, Ohio, will be re-elected to this office. Charles F. Goodwin will be re-elected secretary-treasurer and historian. At the last annual meeting at Washington, D. C., fifty-eight companies in the general ware line were registered, representing 633 kilns, with three companies in the sanitary ware branch of the industry, representing 87 kilns.

Reparation Dyes Resold in U. S. by Italy

Of the dyestuffs imported into the United States in February, 26 per cent were reparation dyes, sold on the American market by Italians, according to statistics recently made public by the Department of Commerce. According to this report every pound of dyes brought in from Italy and much of those from France were made in Germany.

Officials of the Tariff Commission say these dyes were granted to the Italian Government as reparations and resold to American importers. It is the well-established policy of Italy to take reparations in any goods whatever and convert them into gold.

Helium to Fill Dirigible

Helium will be used for the inflation of the balloon in the navy's first rigid dirigible, ZR-1, which is being built at Lakehurst, N. J. The dirigible will require 2,000,000 ft. of the gas. Although the United States possesses helium in comparatively large quantities, this plan will draw heavily upon the supply. Nevertheless, helium is to be used regardless of cost, in order to reduce the explosion risk to a minimum.

The recent navy appropriation bill increased the amount allowed for the production of helium, permitting the continuous operation of the plant at Fort Worth. It was planned to produce 12,000,000 cu.ft. during the next fiscal year. At that time the combined helium stocks of the army and navy were 1,822,000 cu.ft.

Bureau of Mines Reviews Rain-Making Scheme

Method of Precipitating Rain and Dissipating Fog Described by Dr. Moore, the Bureau's Chemist

Dr. R. B. Moore, chief chemist of the Bureau of Mines, has authorized the following statement in connection with the work of L. F. Warren and Dr. W. D. Bancroft in connection with the dissipation of clouds and the precipitation of rain with electrified sand:

About 2 years ago Mr. Warren came to my office several times and talked over the plans of himself and Dr. Bancroft in the dissipation of clouds and fog and the possible precipitation of rain from such clouds. He explained his ideas and I encouraged him, because the scheme at least showed possibilities of success, although its value could be determined only by actual trial. I am very glad to know of the results of the recent tests and that my judgment was not entirely wrong.

Use of a Dielectric

The method consists in charging a dielectric, such as fine sand, with a static charge, and then sprinkling this sand over the top of a cloud by means of an airplane. As everyone knows, clouds consist of minute particles of water, a large proportion of which are charged. All the particles in the same cloud are charged either positively or negatively, and therefore as they carry the same sign, they repel one another when they come into too close contact. This militates against the coalescence of the particles to a size that allows them to fall through the atmosphere in the form of rain. Anything which will dissipate the charge on the particles will help coalescence, and therefore will assist in precipitation.

There was no doubt in my mind 2 years ago that the scheme of Mr. Warren would have at least partial success. The whole question that had to be proven, however, was to what extent precipitation in the upper part of the cloud would have on the rest of the cloud below. In other words, would the effect be cumulative so that the whole cloud could be dissipated? This point could be cleared up only by trial.

The Apparatus Used

I have had no opportunity for personal observation in connection with tests already made, but I have read the affidavits of the observers and also of the army fliers who took part in the tests. From these affidavits it appears that a single airplane has been able to dissipate a cloud a mile or two long and over 1,000 ft. deep in a few minutes by using about 100 lb. of charged sand.

The apparatus which Mr. Warren uses for charging the sand is not by any means perfected, and he is able to get only 12,000 or 14,000 volts on the particles. In addition, it has not been possible so far to charge more than a small proportion of the sand grains. I see no reason why the voltage cannot be increased with improved apparatus up to 30,000 volts or even more, and also why the percentage of charged grains cannot be greatly increased. Under such conditions a still greater effect should be obtained with a given weight of sand.

Possible Utility

The work is still in its initial stages and it is difficult to state definitely its possibilities in the future. No trials have yet been made on fog, as the conditions have not yet been favorable for an airplane to go up in a fog and make the tests.

Fogs are a combination of mists or "clouds" in contact with the earth, mixed with more or less smoke. Whether it will be more difficult or easier to get rid of such fogs than has been the case with clouds high up in the air is yet to be determined, but the methods certainly show great promise and justify a complete investigation by a satisfactory series of trials with improved apparatus. If such fogs can be dissipated, the results would be of tremendous value to cities such as London and San Francisco, besides being of great use to the Air Service in connection with its flying fields.

Refractories Investigation Begins

The Bureau of Mines laboratory car "Holmes" is now at the plant of the American Refractories Co. in Baltimore, where initiatory work on the co-operative investigation between the Refractories Manufacturers Association and the bureau has begun. The objects of this investigation are to decrease fuel consumption in burning refractories, to shorten the time of burning, and to improve the quality of the product.

Paint Men Not Indicted

The United States District Attorney in Philadelphia has announced that the findings of the federal grand jury will lead to no indictments against the Paint Manufacturers Association of the United States or any of its members. Charges of price fixing, restraints of trade and other alleged violations of the Sherman anti-trust law were investigated.

California Chemists Are Active

On March 2, Professor Blasdale of the University of California addressed the California Section of the American Chemical Society of San Francisco on "Equilibria in Solutions Containing Carbonates and Chlorides of Sodium and Potassium." G. H. West also read a paper on "The Manufacture and Purification of Oil Gas."

Discriminating Law Hits Bauxite Producers

The Legislature of Arkansas has passed a bill that proposes a production tax of 25c. per ton on bauxite produced in the state. This amounts to 2½ per cent, based on the average price of bauxite ($10) in 1921 and 1922; 3.9 per cent, based on the average selling price ($6.38) of domestic bauxite in 1921, and 5.2 per cent, based on the average selling price of the domestic product before the war. That the new measure is discriminatory is indicated by the fact that coal is taxed but 1c. per ton and timber bears a burden of only 7c. per 1,000 ft.

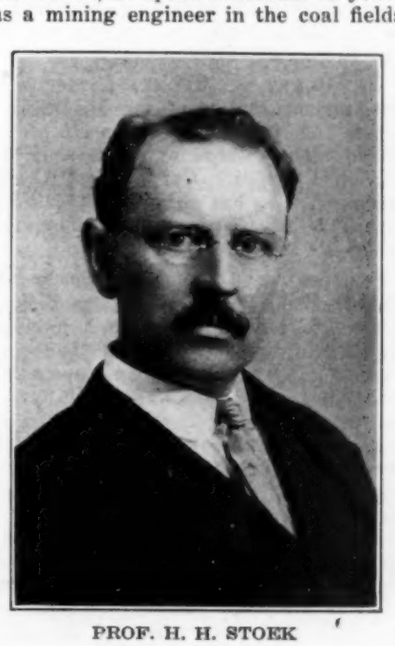
The effect of the measure, if signed by the Governor, may well be to curtail production of bauxite in the state, which contributes 90 per cent of the domestic supply. Such curtailment would stimulate foreign competition and prove highly detrimental to the exploitation of domestic deposits.

Obituary

FREDERICK BENNETT RANDALL, secretary and treasurer of the Mann Linseed Oil Co., Buffalo, N. Y., with which he had been for many years, died recently.

In the sudden death on March 1 of Prof. HARRY HARKNESS STOEK, the coal industry lost one of its foremost investigators and the chemical and metallurgical industries lost a friend whose advice and counsel have been reflected in many fundamental studies of our fuel problems.

Professor Stoek had been professor of mining engineering and head of that department in the University of Illinois since 1909. After being graduated from Lehigh University in 1887 and completing a year of post-graduate work in mining and metallurgy at the same institution, he spent a number of years as a mining engineer in the coal fields



PROF. H. H. STOEK

of Pennsylvania. Returning to Lehigh in 1900, he was instructor in mining, metallurgy and geology. It was in this capacity he became familiar with the iron and zinc industries of eastern Pennsylvania, as well as the anthracite coal mines of that section.

For 9 years prior to September, 1909, Dr. Stoek was managing editor of *Mines and Minerals*. Later on in connection with other editorial work he revised and edited the mining publications of the International Correspondence School, "Coal and Metal Miners' Pocketbook," Fulton's "Coke," Lake's "Prospecting for Gold and Silver" and "Examination Questions for Certificates of Competency in Mining" and prepared for the United States Geological Survey a chapter on "Anthracite" included in the Twenty-second Annual Report of the Survey. His own publications include several well-known volumes on coal mining, mining education and the problems of coal storage. It was toward the last-named problems that his more recent efforts have been directed. He had just been appointed by the American Engineering Council to serve on a committee of engineers to make a detailed study of storage for commercial and industrial purposes. During the Christmas holidays he aided in the preparation of the preliminary report on coal storage for the Federal Fact-Finding Coal Commission, of which he was a member.

Professor Stoek was a widower at the time of his death. His wife was Miss Miriam Ricketts, of Wilkes-Barre, Pa., to whom he was married Dec. 20, 1894. He is survived by one daughter, Miss Leigh Stoek, of Urbana, Ill. He was just past 57 years of age, having been born in Washington, D. C., Jan. 16, 1866.

IRA A. SHOFF, chief engineer, West Penn Steel Co., Brackenridge, Pa., since its organization in 1908, died on February 28.

Personal

LEASON H. ADAMS, of the Geophysical Laboratory, spoke before the Chemical Society of Washington, March 8, on "Reactions and Properties of Substances at High Pressures."

PERRY H. BASCOM and CLEO HAROLD KIDWELL, formerly with Raymond F. Bacon, consulting chemical engineer at 50 East 41st St., New York, have organized the firm of Kidwell & Bascom, Inc., with offices and laboratory at 27 Thames St., New York. The new firm will do consulting chemical engineering work and developmental research. Raymond F. Bacon is a director of the firm, and Elizabeth N. Kidwell is bacteriologist.

Dr. CHARLES B. BAZZONI, professor of experimental physics, University of Pennsylvania, spoke before the Franklin Institute, March 8, on "Ionization and Resonance Phenomena."

Dr. HENRY R. CURME, formerly a non-resident Fellow of the Mellon Institute of industrial Research, connected with the staff of the Carbide & Carbon Chemicals Corporation, Clendenin, W. Va., has accepted a position with Savell, Sayre & Co., Inc., Niagara Falls, N. Y.

FRANCIS B. DAVIS, JR., connected with E. I. du Pont de Nemours & Co., Wilmington, Del., in an engineering capacity in different departments for a number of years, has been appointed assistant general manager of the pyralin department, and will assume his new duties about March 15. During the war period he was identified with the black powder department as division superintendent, and later was successively assistant engineer, resident engineer and assistant manager at the guncotton plant at Hopewell, Va. He acted as assistant manager in connection with the construction of the Old Hickory guncotton and smokeless powder plant for the United States Government. At the close of the war he was appointed vice-president and general manager of the du Pont Chemical Co.

Dr. HARRY ESSEX, professor of physical chemistry at Syracuse University, addressed the Syracuse Section of the American Chemical Society on March 9. His subject was "Isotopes."

General AMOS A. FRIES gave an interesting address at the February meeting of the Delaware Section of the American Chemical Society, Wilmington, on "Chemical Warfare Materials—What They Are, How Produced and Their Peace-Time Uses."

Dr. WILLIAM D. HARKINS, professor of physical chemistry at Chicago University, gave a course of three technical lectures, March 7, 8 and 9, at Carnegie Institute of Technology, Pittsburgh, on "Isotopes and the Building and Disintegration of Atoms."

CHARLES H. MACDOWELL, president of the Armour Fertilizer Works, sailed for Europe recently and expects to return about the middle of April.

Dr. ROYAL A. MEEKER has been appointed Commissioner of Labor and Industry of the State of Pennsylvania by Governor Pinchot, to succeed Dr. Clifford B. Connelley. Dr. Meeker has been chief of the scientific division, international labor office, of the League of Nations since August, 1920. Previously, from 1913 to 1920, he served as United States Commissioner of Labor Statistics by appointment of President Wilson. Since 1916 he has been secretary and treasurer of the International Association of Industrial Accident Boards and Commissioners. Dr. Meeker is a native of Pennsylvania and attended the Iowa State College, Columbia University and the University of Leipzig.

Dr. EDMUND S. MERRIAM of Marietta, Ohio, has resigned as chief chemist for the Safe-Cabinet Co. in order to resume his consulting work in connection with natural gas, casinghead gasoline and carbon black.

F. P. PALMER, a member of the metallurgical staff of the Carpenter Steel Co., Reading, Pa., gave a comprehensive and illuminating address on the subject of "Tool Steel" at the meeting of the Lehigh Valley Chapter of the American Society for Steel Treating, Easton, Pa., March 1.

CHARLES W. PHELLIS, general manager of the Pyroxlin plastics division of E. I. du Pont de Nemours & Co., has resigned to follow personal interests. Mr. Phellis is widely known in the explosive industry of the U. S.

EDGAR S. ROSS, for a number of years engaged in research dealing with production of metallic tantalum and columbium and more recently chemist and metallurgist for McKechnie Bros., Inc., of Philadelphia, has recently accepted an industrial fellowship at the Mellon Institute of Industrial Research, University of Pittsburgh.

C. A. UNDERWOOD, formerly chief chemist of the American Refractories Co., at Joliet, Ill., has been transferred to the sales department at New York as New England representative.

SAMUEL M. VAUCLAIN, president of the Baldwin Locomotive Works, has accepted an invitation from Dr. Thomas S. Baker, president of the Carnegie Institute of Technology, to address the general assembly of students March 14.

Dr. F. C. WEBER, for many years chemist in the Bureau of Chemistry, has resigned to accept a position with the Fleischmann Co., New York City.

JOHN MORRIS WEISS, consulting chemical engineer, of Weiss & Downs, New York, has been selected by the Manufacturing Chemists' Association to serve as its representative on the recently formed sub-committee on benzol poising of the Chemical Section of the National Safety Council.

EDGAR C. WELBORN and WILLIAM CHAPIN HUNTINGTON announce the formation of a partnership to extend the work heretofore carried on under the name of E. C. Welborn. They will continue to make business surveys of industrial enterprises.

The Social Organization of Hungarian Engineers has elected the following officers for the coming year: President, Alexander Strobl, Chemical Engineer; vice-president, Dr. Adalbert Elek, of the Rockefeller Institute; secretary-treasurer, Julian J. Wittal, M.E. (132 Nassau St., New York City). This organization, which comprises in its membership most of the engineers of Hungarian extraction, had a very successful dance-dinner at the Hotel McAlpin, on March 3. The Hungarian Consul-General attended.

Market Conditions

In Chemical, Metallurgical and Allied Industries

A Survey of the Economic and Commercial Factors That Influence Trade in Chemicals and Related Commodities Prevailing Prices and Market Letters From Principal Industrial Centers

Business Profits in 1922

Study of Net Earnings of Important Industrials Offers a Better Index of Business Than Statistics of Production, Consumption, Sales and Prices

THE season of annual reports is with us again and careful students of business are profiting by an opportunity to examine industrial earnings and to compare them with records of past years. While current statistics of production and consumption have offered a fairly precise measure of business activity, there has existed no accurate measure of that more important aspect of business, the amount of net profits. Recently in connection with its "Monthly Review of Credit and Business Condition" the Federal Reserve Bank in New York has tabulated the published statements of net profits for the year 1922 of 122 concerns engaged in production, wholesale and retail trade and public service.

Table I and the accompanying chart show the results of this tabulation by 10 separate groups and in the aggregate for all groups. There is also shown the net operating income of the 193 Class I railroads. In each case the 1919 figures are taken as a basis of 100 per cent.

In every group 1922 net profits were larger than net profits in 1921, but there is large variation between the different groups in the amounts of increase which they show. In 4 of the 10 groups, and in the case of the railroads as well, 1922 net profits were equal to or larger than those of 1919. The aggregate figures for the 10 groups, however, show 1922 figures considerably below those for either 1919 or 1920, reflecting reduced earnings in the steel and other metal industries.

In general, the figures show that 1922 net profits were highest, in relation to 1919, in those industries which deal most directly with the individual consumer. This is true in the cases of food and food products, public utilities, tobacco and clothing. On the other hand it is significant that in the industries of the type of the chemical and metallurgical producers whose production is directed to supplying industry rather than the final consumer, profits in 1922 lagged considerably behind those in 1919 or 1920. The railroads show consistent gains since the year 1920, but even so the percentage of net operating income to property valuation continues to be less than 5½ per cent specified in the law.

A further reflection of changing business conditions is found in the number of concerns which reported deficits. Of the 122 concerns reported, the number showing deficits in each year were as follows:

1919	5
1920	9
1921	34
1922	18

The report points out that in interpreting these data it should be borne in mind that they are simply for a group of concerns, figures for which were available, and are not necessarily typical of all the concerns which deal in the products represented. In a few cases where it has been necessary, fiscal years not corresponding exactly with the calendar years have been used.

Annual reports for a number of prominent companies in the chemical and allied industries will be found on page 520.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	176.76
Last week	176.71
March, 1922	156.00
March, 1921	157.00
March, 1920	252.00
April, 1918 (high)	286.00
April, 1921 (low)	140.00

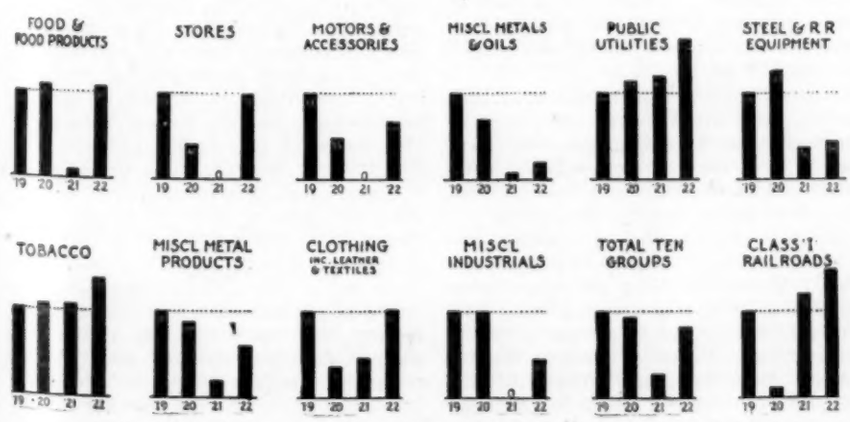
The prices of all commodities represented by this index number remained at the same level reported last week. A very minor increase in the price of salt cake was responsible for the slight change in this week's index number.

TABLE I—INDUSTRIAL EARNINGS IN 1919, 1920, 1921 AND 1922

(Computations of net profits have been before dividends, but after all fixed charges and tax deductions.)

Group	No. of Corporations	(Thousands of Dollars) 1919	1920	1921	1922
Food products	15	51,501	55,255	10,270	54,408
Stores	7	41,447	16,658	*9,938	40,752
Motors	11	53,767	25,757	*23,576	36,408
Miscellaneous metals and oils	8	10,851	7,544	959	2,313
Public utilities	24	59,970	67,872	71,513	97,222
Steel and railroad equipment	14	140,626	176,661	50,466	62,738
Tobacco	9	29,118	30,822	31,007	39,902
Miscellaneous metal products	10	24,996	22,038	5,281	15,228
Clothing (including leather and textiles)	12	28,193	10,312	13,371	28,670
Miscellaneous industrials	12	36,952	36,913	*13,025	17,175
Total 10 groups	122	477,421	449,832	136,328	394,816
Class I RR's	193	516,290	58,152	615,946	776,421

* Deficit.



ANNUAL NET PROFITS OF 122 MANUFACTURING AND MERCHANDISING CONCERNS AND OF THE 193 CLASS I RAILROADS
(1919 PROFITS = 100 PER CENT)

Goodrich Earns $3,000,000

The annual report of the B. F. Goodrich Co. for 1922 shows that net sales of the company's products amounted to $93,649,710.08. From this was deducted manufacturing, selling and general administrative expenses of $86,631,163.84 and depreciation and interest provisions of $4,806,060.16. This leaves a net profit (including the miscellaneous income) of $3,047,769.66.

U. S. Gypsum Doubles Earnings

The United States Gypsum Co. and subsidiary companies report for 1922 shows total earnings after expenses incident to operations, etc., of $4,370,770, contrasted with $2,639,552 in 1921, and a surplus after dividends of $2,080,493, against $910,587 in the preceding year. At the end of 1922 the total surplus was $5,615,795, against $3,535,302 on Dec. 31, 1921.

Mathieson Alkali Earnings Show Big Gains in 1922

The Mathieson Alkali Works, Inc., shows its earnings for 1922 to have been $1,633,886 after deducting expenses and other charges. This contrasts with earnings of $366,036 in 1921. The 1922 surplus after dividends was $823,365 as against a deficit of $241,893 in the previous year. The Mathieson company's surplus on Dec. 31, 1922, amounted to $1,949,716, as contrasted with $1,308,432 at the end of 1921.

National Lead Reports Big Earnings

The net earnings of the National Lead Co. for 1922 were $4,927,548 after deducting all expenses, including tax reserves. In 1921 the company's earnings were $3,481,512.

In addition to providing for the regular dividends on the preferred stock, the profits are sufficient to pay $15.59 a share on the outstanding common stock, which totals $20,655,400. Last year the earnings available for the common stock were equivalent to $8.50 per share.

Corn Products Earns $15,453,918

During the year ended Dec. 31, 1922, the Corn Products Refining Co. had a total net income, according to its recent annual report, of $15,453,918, as compared with $10,742,374 in 1921. E. T. Bedford, the president of the company, points out in his letter to the stockholders that the company's surplus was reduced by $20,000,000 as a result of readjustment in the value of operating plants and certain intangible assets such as good will and patent rights.

The consolidated balance sheet on Dec. 31, 1922, shows cash holdings of $1,663,060, as compared with $1,457,305 in 1921.

Better Activity as Prices Advance in New York

Phenol, Acetone, Tin Salts and Barium Carbonate Feature Chemical and Allied Markets

Advances were quite general throughout the list during the past week and the market was fairly active. Manufacturers of acetone announced a new advance due to the increased production costs. Producers of tin salts raised their prices on account of the increase in the metal. One of the outstanding features of the week's trading was the sharp advance in phenol. Scarcity of spot supplies, together with a heavily sold up condition at the works, was directly responsible for the sharp increase. Producers of potassium nitrate announced a reduction of 1c. per lb., on account of the lack of consuming interest. The new level has brought some noticeable trading into producing quarters. Dealers in arsenic report a quiet market, temporarily at least, with quotations fractionally lower for spot and shipment material. Trading in barium carbonate has been more pronounced, with importers somewhat higher on spot. The alkali market continued to improve for export. Caustic soda inquiries were more numerous and several fair-sized sales were reported by the export association. Soda ash continued along steady lines. Oxalic acid, bichromate of potash and soda, copper sulphate, permanganate of potash and caustic potash were very firm throughout the interval, with quotations somewhat higher among first hands.

Principal Price Changes

Acetone — Leading producers announced an advance of 1c. per lb. on carload quantities. Quotations range around 22@22½c. per lb. The demand continues along moderate lines.

Arsenic—Trading has been rather quiet during the week, with resale dealers offering spot goods at 15@15½c. per lb. Shipments were held at 15½c. Consumers have not shown any desire to purchase at present high levels.

Barium Carbonate—This product has shown material strength and leading importers are asking $75 per ton for spot goods. Goods afloat were held around $70 per ton.

Bleaching Powder — Producers reported sales at $2.20 per 100 lb. f.o.b. works for nearby shipments. The market is in a very strong position, with most producers well sold up. Resale lots were quoted around 2½c. per lb.

Caustic Soda—Dealers quoted the market firm at $3.45@$3.50 per 100 lb. f.a.s. There has been an appreciable improvement during the interval, with several large sales reported to South America and Japan. Domestic caustic on spot was quoted at $3.50 per 100 lb. for carload lots and $3.75 for smaller quantities, ex-store.

Caustic Potash—Higher quotations were reported for spot material. Importers quoted 88-92 per cent at 8@8½c. per lb., with several fair-sized sales at this figure. Higher importing costs, together with the scarcity of spot stocks, were directly the cause of the increased activity.

Phenol — Spot prices have been sharply advanced, due to the extreme scarcity of spot material and the heavily sold up market at the works. Goods on spot were held around 50c. per lb., but actual trading was mostly for small lots. The new level represents an increase of over 15c. per lb. during the past 10 days and also establishes a new high price since January, 1919.

Potassium Nitrate—Manufacturers announced a reduction on all grades. Pure doubled refined granulated is quoted at 6¼c. per lb., in barrels, the powdered at 7¼c. and the large crystals at 7¾c.

Potassium Bichromate—Dealers were somewhat firmer in their views on spot goods, and quotations were fractionally higher. Producers quoted spot material around 10c. per lb. f.o.b.

Potassium Permanganate—Spot offerings were quite scarce, and dealers quoted around 19½c. per lb. Consuming demand has shown an appreciable increase.

Prices Advance Materially in the St. Louis Market

Higher Quotations on Many Items Due to Curtailment of Imports by Ruhr Occupation

ST. LOUIS, March 8, 1923.

Important and striking advances in the drug market since our last letter were the naming of higher schedules on salicylates, bismuth and iodide preparations. In the industrial chemical market there were also a number of important items that were materially advanced, this due principally to developments in the Ruhr situation. Shipments of chemicals from that part of Germany have been materially curtailed, and would not be surprising if they ceased altogether in the near future. The potash salts are the most affected by the curtailment, and spot stocks are hardly obtainable, with prices the highest for many months. Other industrial chemicals and alkalis have also been strengthened considerably, resulting in a heavy buying movement. Transportation facilities are somewhat better, but are still below normal; however, it is the opinion of those directly interested that conditions will greatly improve in the next month or 6 weeks.

Alkalis

The alkali market is firmer now than at any time in the recent past, and while there has been no general increase in schedules, business has been brisk. *Caustic soda* has not changed in price, though a decided improvement in volume of business transacted is reported. *Soda ash*, in sympathy with *caustic*, is showing improvement.

Schedules have not changed on this item, but prices are firm. *Bicarbonate of soda* has strengthened considerably, 25c. per 100 lb. having been added to the regular schedule recently. Good business on this item is reported. *Sal soda* has been rather quiet recently, though no price reductions have been made. Factors on this item expected this condition to improve.

General and Special Chemicals

Heavy *mineral acids* are going well with a firm market. There have been no startling developments in the *citric acid* market, and while there was a slight increase, the market is still lacking volume. The demand for *oxalic acid* has been very light and the market weak. *Tartaric acid* has not been moving in heavy volume, but the season is approaching when a greater demand should be forthcoming. *Aqua ammonia*, 26 deg., is moving along quiet lines with no change in price. There has been no change in *white arsenic powdered*, and the market is ruling today at 16@16½c. f.o.b. New York. Spot stocks are very scarce and buying is light. Since the advance on bismuth and iodide preparations a very satisfactory business is being transacted. *Glycerine* remains very firm; in fact, is a producers' market. The demand is excellent; prices are holding at 18½c. in drums both for open market and contract quotations. There is a pronounced scarcity of *phenol*, and domestic producers are not in a position to take care of the business. The imported article has advanced and considerably higher prices are expected to prevail in the next few weeks. The spareness of stocks is holding *permanganate of potash* in a strong position and spot goods are hardly obtainable. *Potash carbonate* and *caustic* are much stronger and ruling at higher prices. As a result of the higher market on phenol, *salicylates* have also advanced and stocks in the hands of producers are limited. *Sulphur* is moving in good volume and numerous sales are being reported. Prices are generally firm and declines are not expected. The zinc market is advancing steadily, and *spelter* is quoted today at $7.85 per 100 lb. St. Louis. Excepting during the war period this is the highest price obtained in the spelter market for many years. The *zinc dust* market is also in excellent condition and is advancing in sympathy with the spelter. *Zinc sulphate* is quoted today at 3¼@3⅜c. f.o.b. St. Louis in carload lots and 4c. f.o.b. St. Louis in less than carload lots, with a good volume of business transacted.

Vegetable Oils and Paint Materials

Turpentine is still very firm, the price today being the same as of our previous report, the 5-bbl. price being $1.54 per gal., single barrels $1.58. *Linseed oil* has taken a 3c. advance and is now being quoted at $1.03 per gal. in 5-bbl. lots, $1.13 in single barrels, with the usual differential for boiled over raw oil. *Castor oil* has taken another advance and is now quoted at 15c. lb. in drums. The market is entirely in the hands of producers, with one of the largest factors reporting a shortage of supplies.

Producers in this market report a lively business with firm prices and an increased demand. *Floated barytes* is quoted at $26@$28 in carload lots f.o.b. shipping point, with a $4 differential for single-ton lots. Gilders' *whiting* in carloads is quoted at $18@$20. *Commercial whiting* is quoted at $17 per ton in carloads, with a $3 differential for ton lots applying to both grades.

Iron and Steel Production Reach Record Rates

Market Gaining Strength With Advancing Prices and Heavy Turnover

PITTSBURGH, March 9, 1923.

Production of pig iron and steel has within the last 2 or 3 weeks exceeded the highest rate attained since the armistice, in March, 1920, and is in line, barring accidents, to break the high record of all time, reached in September, 1919. Already the rate in both pig iron and steel is above the greatest production ever attained in a full calendar year.

So far as the market itself goes, there is appearance of greater and greater strength week by week. During January and February the strong features were the advances in finished steel products, with a very heavy turnover in actual tonnage in January. In February one of the outstanding strong points was the refusal of many mills to sell beyond certain dates. In the past week two strong points have been advances in both pig iron and semi-finished steel, with the spread of a delivery premium market in some finished products.

Price Premiums Common

In bars, shapes and plates the basis price or regular market remains at 2.25c., but there are few sellers at this level, and then only for very late delivery. Bars are moving in small lots for early shipment at premiums of from $3 to $5 a ton, while occasionally shapes have gone at such premiums. Plates present the strongest prompt market, as some fairly good-sized tonnages, chiefly for oil tank work, have gone at 2.60c., or $7 a ton premium.

Wire products are difficult to buy at any price, and the market is relatively inactive, with heavy deliveries being made on old contracts. Tubular goods are also very difficult to buy. Consumers and jobbers may be fairly well covered, but their active inquiry would not so indicate. Orders are frequently sent to mills without previous inquiry, and such orders are frequently scaled down in tonnage or rejected entirely. The National Tube Co. has withdrawn as a seller of line pipe or oil country goods, except that it will accept some orders from regular customers, subject to price ruling at date of shipment, and at least one independent has adopted the same policy.

The sheet prices of the Steel Corporation, as recently advanced to 2.65c. for blue annealed, 3.50c. for black, 4.60c. for galvanized and 5c. for automobile sheets, are practically nominal, the company having been sold out for second quarter for some time, while it will hardly open order books for third quarter before about the middle of April. Independents, instead of getting on a uniform basis, as was recently the prospect, are showing a wider range of position. Some have not opened order books even for April shipment, others are quoting for April and others for second quarter, while prices are not uniform. The more common quotations are 2.75c. for blue annealed, 3.60c. for black and 4.75c. for galvanized. Yesterday the Wheeling Steel Corporation and Superior Steel Co. announced advances in their prices to 3.85c. for black and 5c. for galvanized. Automobile sheets alone are uniform in the independent market, mills having opened order books last week for second quarter at 5.35c.

Semi-Finished Steel Irregular

Expectation lately has been that the Steel Corporation would name a $40 price on semi-finished steel for second quarter to the few customers it has retained and that independents would make the same price to their regular customers. In the past week, however, the McKinney Steel Co., Cleveland, has sold some fair-sized tonnages in sheet bars and slabs at $45, Youngstown basis. That figure represents the only market now quotable. A prediction is that the corporation price will be $40 and that independents will split the difference to regular customers, making a price of $42.50.

Is the End in Sight?

While all the superficial market indications are of increasing strength week by week, it is obvious that the market has been stiffening at a dangerous pace and some observers have already grown very suspicious of the future. Clearly the steel market for some time past has not been one that could continue indefinitely. It has not had in it the elements of self-perpetuation. A given batch of purchases has not paved the way for another, but rather has produced price advances and made the mills more reserved about selling additional tonnages. What is occurring is simply a "movement," and thus the question is simply how long it will last. Particular uncertainty exists on account of some mills not having sold far ahead. If mills had all pursued the same policy, as they did before the war, the market could turn quiet at any moment, and production, shipments and consumption would proceed at a high rate for the major part of the year, the industry running on "momentum." That is what it did in 1907, through October. If the market should turn quiet in the near future some mills might in a short time find themselves in need of orders.

Current Prices in the New York Market

FOR CHEMICALS, OILS AND ALLIED PRODUCTS

Although these prices are for the spot market in New York City, a special effort has been made to report the American manufacturer's quotations whenever available. In many instances these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported and resale stocks are reported when of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetic anhydride, 85%, drums	lb.	$0.36 – $0.38
Acetone, drums	lb.	.22 – .23
Acid, acetic, 28%, bbl.	100 lb.	3.15 – 3.40
Acetic, 56%, bbl.	100 lb.	6.25 – 6.50
Glacial, 99½%, carboys	100 lb.	12.00 – 12.50
Boric, crystals, bbl.	lb.	.11½– .11¾
Boric, powder, bbl.	lb.	.11 – .11½
Citric, kegs	lb.	.49 – .50
Formic, 85%	lb.	.15 – .17
Gallic, tech.	lb.	.45 – .50
Hydrochloric, 18° tanks, 100	lb.	.90 – 1.00
Hydrofluoric, 52%, carboys	lb.	.12 – .12½
Lactic, 44%, tech., light, bbl.	lb.	.11½– .12
22% tech., light, bbl.	lb.	.05½– .06
Muriatic, 20°, tanks, 100	lb.	1.00 – 1.10
Nitric, 36°, carboys	lb.	.04½– .05
Nitric, 42°, carboys	lb.	.06 – .06½
Oleum, 20%, tanks	ton	17.00 – 18.00
Oxalic, crystals, bbl.	lb.	.12½– .13
Phosphoric, 50% carboys	lb.	.08 – .09
Pyrogallic, resublimed	lb.	1.50 – 1.60
Sulphuric, 60°, tanks	ton	9.00 – 10.00
Sulphuric, 60°, drums	ton	12.00 – 14.00
Sulphuric, 66°, tanks	ton	14.50 – 15.00
Sulphuric, 66° drums	ton	19.00 – 20.00
Tannic, U.S.P., bbl.	lb.	.65 – .70
Tannic, tech., bbl.	lb.	.40 – .45
Tartaric, imp. crys., bbl.	lb.	.30½– .31
Tartaric, imp., powd., bbl.	lb.	.31 – .32
Tartaric, domestic, bbl.	lb.	.31 – .32
Tungstic, per lb.	lb.	1.00 – 1.20
Alcohol, butyl, drums, f.o.b. Terre Haute	lb.	.23 – .25
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.75 – 4.95
Alcohol, methyl (see Methanol)		
Alcohol, denatured, 188 proof No. 1	gal.	.38 – .40
Alum, ammonia, lump, bbl.	lb.	.03½– .03¾
Potash, lump, bbl.	lb.	.03 – .03¼
Chrome, lump, potash, bbl.	lb.	.05½– .05¾
Aluminum sulphate, com., bags	100 lb.	1.50 – 1.65
Iron free bags	lb.	.02½– .02¾
Aqua ammonia, 26°, drums	lb.	.06½– .07½
Ammonia, anhydrous, cyl.	lb.	.30 – .30½
Ammonium carbonate, powd. casks, imported	lb.	.09½– .10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 – .14
Ammonium nitrate, tech., casks	lb.	.10 – .11
Amyl acetate tech., drums	gal.	2.80 – 3.05
Arsenic, white, powd., bbl.	lb.	.15 – .15½
Arsenic, red, powd., kegs	lb.	.12½– .13
Barium carbonate, bbl.	ton	75.00 – 77.00
Barium chloride, bbl.	ton	87.00 – 90.00
Barium dioxide, drums	lb.	.18 – .18½
Barium nitrate, casks	lb.	.08 – .08½
Barium sulphate, bbl.	lb.	.04 – .04½
Blanc fixe, dry, bbl.	lb.	.04 – .04½
Blanc fixe, pulp, bbl.	ton	45.00 – 55.00
Bleaching powder, f.o.b. wks., drums	100 lb.	2.20 – 2.50
Resale drums	100 lb.	2.50 – 2.75
Borax, bbl.	lb.	.05½– .05¾
Bromine, cases	lb.	.28 – .30
Calcium acetate, bags	100 lb.	3.50 – 3.60
Calcium carbide, drums	lb.	.04½– .04¾
Calcium chloride, fused, drums	ton	22.00 –23.00
Gran. drums	lb.	.01½– .01¾
Calcium phosphate, mono, bbl.	lb.	.06½– .07
Camphor, cases	lb.	.91 – .93
Carbon bisulphide, drums	lb.	.07 – .07½
Carbon tetrachloride, drums	lb.	.09½– .10
Chalk, precip.—domestic, light, bbl.	lb.	.04½– .04¾
Domestic, heavy, bbl.	lb.	.03½– .03¾
Imported, light, bbl.	lb.	.04½– .05
Chlorine, liquid, cylinders	lb.	.06 – .06½
Chloroform, tech., drums	lb.	.35 – .38
Cobalt oxide, bbl.	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks.	ton	16.50 – 20.00
Copper carbonate, bbl.	lb.	.19 – .20
Copper cyanide, drums	lb.	.47 – .50
Copper sulphate, crys., bbl., 100	lb.	6.40 – 6.50
Cream of tartar, bbl.	lb.	.24 – .25
Dextrine, corn, bags	100 lb.	3.25 . 3.50
Epsom salt, dom., tech., bbl.	100 lb.	2.00 – 2.25
Epsom salt, imp., tech., bags	100 lb.	1.10 – 1.25
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.50 – 2.75
Ether, U.S.P., drums	lb.	.13 – .15
Ethyl acetate, com., 85%, drums	gal.	.80 – .85
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.95 – 1.00
Formaldehyde, 40%, bbl.	lb.	$0.15 – $0.16½
Fullers earth, f.o.b. mines	net ton	16.00 – 17.00
Fullers earth—imp., powd.,	net ton	30.00 – 32.00
Fusel oil, ref., drums	gal.	3.55 – 4.05
Fusel oil, crude, drums	gal.	2.30 – 2.40
Glaubers salt, wks., bags	100 lb.	1.20 – 1.40
Glaubers salt, imp., bags	100 lb.	1.00 – 1.25
Glycerine, c.p., drums extra	lb.	.18½– .19
Glycerine, dynamite, drums	lb.	.17 – .17½
Iodine, resublimed	lb.	4.55 – 4.65
Iron oxide, red, casks	lb.	.12 – .18
Lead:		
White, basic cabonate, dry, casks	lb.	.10 – .10½
White, in oil, kegs	lb.	.12½– .14
Red, dry, casks	lb.	.11½– .12
Red, in oil, kegs	lb.	.13½– .15
Lead acetate, white crys., bbl.	lb.	.13½– .14
Lead arsenate, powd., bbl.	lb.	.23 – .24
Lime-Hydrated, bbl.	per ton	16.80 – 17.00
Lime, Lump, bbl	280 lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.10½– .11
Lithophone, bbl.	lb.	.06½– .07
Magnesium carb., tech., bags	lb.	.08 – .08½
Methanol, 95%, bbl.	gal.	1.23 – 1.25
Methanol, 97%, bbl.	gal.	1.25 – 1.27
Nickel salt, double, bbl.	lb.	.10 – .10½
Nickel salts, single, bbl.	lb.	.11 – .11½
Phosgene		.60 – .75
Phosphorus, red, cases	lb.	.35 – .40
Phosphorus, yellow, cases	lb.	.30 – .35
Potassium bichromate, casks	lb.	.10 – .10½
Potassium bromide, gran., bbl.	lb.	.16 – .23
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½– .06
Potassium chlorate, powd.	lb.	.07 – .08
Potassium cyanide, drums	lb.	.45 – .50
Potassium hydroxide (caustic potash) drums	100 lb.	8.25 – 8.50
Potassium iodide, cases	lb.	3.65 – 3.75
Potassium nitrate, bbl.	lb.	.06½– .07½
Potassium permanganate, drums	lb.	.21 – .22
Potassium prussiate, red, casks	lb.	.80 – .85
Potassium prussiate, yellow, casks	lb.	.37½– .38
Salammoniac, white, gran., casks, imported	lb.	.06½– .06¾
Salammoniac, white, gran., bbl., domestic	lb.	.08 – .08¼
Gray, gran., casks	lb.	.08¼– .08½
Salsoda, bbl.	100 lb.	1.20 – 1.40
Salt cake (bulk)	ton	26.00 – 28.00
Soda ash, light, 58% flat, bags, contract	100 lb.	1.60 – 1.67
Soda ash, light, basis, 48%, bags, contract, f.o.b. wks.	100 lb.	1.20 – 1.30
Soda ash, light, 58%, flat, bags, resale	100 lb.	1.75 – 1.80
Soda ash, dense, bags, contract, basis 48%	100 lb.	1.17½– 1.20
Soda ash, dense, in bags, resale	100 lb.	1.85 – 1.90
Soda, caustic, 76%, solid, drums, f.a.s.	100 lb.	3.45 – 3.70
Soda, caustic, 76%, solid, drums, contract	100 lb.	3.35 3.40
Soda, caustic, basis 60%, wks., contract	100 lb.	2.50 – 2.60
Soda, caustic, ground and flake, contracts	100 lb.	3.80 – 3.90
Soda, caustic, ground and flake, resale	100 lb.	4.00 – 4.15
Sodium acetate, works, bags	lb.	.06 – .06½
Sodium bicarbonate, bbl.	100 lb.	2.00 – 2.50
Sodium bichromate, casks	lb.	.07½– .08
Sodium bisulphate (niter cake)	ton	6.00 – 7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½– .04¾
Sodium chlorate, kegs	lb.	.06½– .07
Sodium chloride	long ton	12.00 – 13.00
Sodium cyanide, cases	lb.	.20 – .23
Sodium fluoride, bbl.	lb.	.09 – .10
Sodium hyposulphite, bbl.	lb.	.03 – .03½
Sodium nitrite, casks	lb.	.08½– .09
Sodium peroxide, powd., cases	lb.	.28 – .30
Sodium phosphate, dibasic, bbl.	lb.	.03½– .04
Sodium prussiate, yel. drums	lb.	.19 – .19½
Sodium silicate (40°, drums)	100 lb.	.80 – 1.15
Sodium silicate (60°, drums)	100 lb.	2.00 – 2.25
Sodium sulphide, fused, 60-62% drums	lb.	.04 – .04½
Sodium sulphite, crys., bbl.	lb.	.03½– .03¾
Strontium nitrate, powd., bbl.	lb.	.09½– .10
Sulphur chloride, yel drums,	lb.	.04½– .05
Sulphur, crude	ton	18.00 – 20.00
Sulphur dioxide, liquid, cyl.	lb.	.08 – .08½
Sulphur, flour, bbl.	100 lb.	2.35 – 3.15
Sulphur, roll, bbl.	100 lb.	$2.00 – $2.50
Talc—imported, bags	ton	30.00 – 40.00
Talc—domestic powd., bags	ton	18.00 – 25.00
Tin bichloride, bbl.	lb.	.13½– .14
Tin oxide, bbl.	lb.	.52 – .54
Zinc carbonate, bags	lb.	.14 – .14½
Zinc chloride, gran, bbl.	lb.	.06 – .07
Zinc cyanide, drums	lb.	.37 – .38
Zinc oxide, XX, bbl.	lb.	.07½– .08
Zinc sulphate, bbl.	100 lb.	2.75 – 3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.80 – $0.85
Alpha-naphthol, ref., bbl.	lb.	1.05 – 1.10
Alpha-naphthylamine, bbl.	lb.	.35 – .38
Aniline oil, drums	lb.	.16½– .17
Aniline salts, bbl.	lb.	.24 – .25
Anthracene, 80%, drums	lb.	.75 – 1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.65 – .70
Anthraquinone, 25%, paste, drums	lb.	.70 – .75
Benzaldehyde U.S.P., carboys	lb.	1.40 – 1.45
Benzene, pure, water-white, tanks and drums	gal.	.30 – .35
Benzene, 90%, tanks & drums	gal.	.26 – .32
Benzene, 90%, drums, resale	gal.	.33 – .35
Benzidine base, bbl.	lb.	.85 – .90
Benzidine sulphate, bbl.	lb.	.75 – .80
Benzoic acid, U.S.P., kegs	lb.	.72 – .75
Benzoate of soda, U.S.P., bbl.	lb.	.57 – .65
Benzyl chloride, 95-97%, ref., drums	lb.	.25 – .27
Benzyl chloride, tech., drums	lb.	.20 – .23
Beta-naphthol, subl., bbl.	lb.	.55 – .60
Beta-naphthol, tech., bbl.	lb.	.24 – .25
Beta-naphthylamine, tech.	lb.	.80 – .90
Carbazol, bbl.	lb.	.75 – .90
Cresol, U.S.P., drums	lb.	.25 – .29
Ortho-cresol, drums	lb.	.24 – .26
Cresylic acid, 97%, resale, drums	gal.	1.40 – 1.50
95-97%, drums, resale	gal.	1.40 – 1.50
Dichlorbenzene, drums	lb.	.07 – .09
Diethylaniline, drums	lb.	.50 – .60
Dimethylaniline, drums	lb.	.41 – .42
Dinitrobenzene, bbl.	lb.	.19 – .20
Dinitroclorbenzene, bbl.	lb.	.22 – .23
Dinitronaphthalene, bbl.	lb.	.30 – .32
Dinitrophenol, bbl.	lb.	.35 – .40
Dinitrotoluene, bbl.	lb.	.20 – .22
Dip oil, 25%, drums	gal.	.25 – .30
Diphenylamine, bbl.	lb.	.50 – .52
H-acid, bbl.	lb.	.80 – .85
Meta-phenylenediamine, bbl.	lb.	.95 – 1.00
Michlers ketone, bbl.	lb.	3.00 – 3.50
Monochlorbenzene, drums	lb.	.08 – .10
Monoethylaniline, drums	lb.	.95 – 1.10
Naphthalene, crushed, bbl.	lb.	.06 – .06½
Naphthalene, flake, bbl.	lb.	.07½– .08
Naphthalene, balls, bbl.	lb.	.08½– .09
Naphthionate of soda, bbl.	lb.	.58 – .65
Naphthionic acid, crude, bbl.	lb.	.60 – .65
Nitrobenzene, drums	lb.	.10 – .12
Nitro-naphthalene, bbl.	lb.	.30 – .35
Nitro-toluene, drums	lb.	.15 – .17
N-W acid, bbl.	lb.	1.15 – 1.20
Ortho-amidophenol, kegs	lb.	2.30 – 2.35
Ortho-dichlorbenzene, drums	lb.	.17 – .20
Ortho-nitrophenol, bbl.	lb.	.90 – .92
Ortho-nitrotoluene, drums	lb.	.10 – .12
Ortho-toluidine, bbl.	lb.	.13 – .15
Para-amidophenol, base, kegs	lb.	1.15 – 1.20
Para-amidophenol, HCl, kegs	lb.	1.20 – 1.25
Para-dichlorbenzene, bbl.	lb.	.17 – .20
Paranitraniline, bbl.	lb.	.74 – .75
Para-nitrotoluene, bbl.	lb.	.55 – .65
Para-phenylenediamine, bbl.	lb.	1.45 – 1.50
Para-toluidine, bbl.	lb.	.90 – .95
Phthalic anhydride, bbl.	lb.	.35 – .38
Phenol, U.S.P., drums	lb.	.50 – .55
Picric acid, bbl.	lb.	.20 – .22
Pyridine, dom., drums	gal.	nominal
Pyridine, imp., drums	gal.	2.30 – 2.50
Resorcinol, tech., kegs	lb.	1.50 – 1.55
Resorcinol, pure, kegs	lb.	2.00 – 2.10
R-salt, bbl.	lb.	.60 – .65
Salicylic acid, tech., bbl.	lb.	.40 – .42
Salicylic acid, U.S.P., bbl.	lb.	.45 – .47
Solvent naphtha, water-white, drums	gal.	.37 – .40
Crude, drums	gal.	.22 – .24
Sulphanilic acid, crude, bbl.	lb.	.18 – .20
Thiocarbanilide, kegs	lb.	.35 – .38
Toluidine, kegs	lb.	1.20 – 1.30
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars	gal.	.35 – .37
Toluene, drums	gal.	.40 – .43
Xylidines drums	lb.	.40 – .45
Xylene, pure, drums	gal.	.45 – .50
Xylene, com., drums	gal.	.40 – .42
Xylene, com., tanks	gal.	.30 – ....

Naval Stores

Rosin B-D, bbl.	280 lb.	$6.15 –	
Rosin E-I, bbl.	280 lb.	6.25 –	$6.40
Rosin K-N, bbl.	280 lb.	6.55 –	6.95
Rosin W.G.-W.W., bbl.	280 lb.	7.35 –	8.05
Wood rosin, bbl.	280 lb.	6.25 –	
Turpentine, spirits of, bbl.	gal.	1.53 –	1.54
Wood, steam dist., bbl.	gal.	1.35 –	
Wood, dest. dist., bbl.	gal.	1.25 –	
Pine tar pitch, bbl.	200 lb.	–	6.00
Tar, kiln burned, bbl.	500 lb.	–	12.00
Retort tar, bbl.	500 lb.	–	11.00
Rosin oil, first run, bbl.	gal.	.43 –	
Rosin oil, second run, bbl.	gal.	.47 –	
Rosin oil, third run, bbl.	gal.	.53 –	
Pine oil, steam dist.	gal.	–	.90
Pine oil, pure, dest. dist.	gal.	–	.85
Pine tar oil, ref.	gal.	–	.46
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	–	.35
Pine tar oil, double ref., bbl.	gal.	–	.75
Pine tar, ref., thin, bbl.	gal.	–	.25
Pinewood creosote, ref., bbl.	gal.	–	.52

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$.13½ –	$.13¾
Castor oil, AA, bbl.	lb.	.14 –	.14½
Chinawood oil, bbl.	lb.	.19 –	.19½
Coconut oil, Ceylon, bbl.	lb.	.09½ –	.9¾
Coconut oil, Cochin, bbl.	lb.	.09½ –	.10
Corn oil, crude, bbl.	lb.	.12 –	.12½
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.10 –	
Summer yellow, bbl.	lb.	.12 –	.12½
Winter yellow, bbl.	lb.	.13 –	.13½
Linseed oil, raw, car lots, bbl.	gal.	.98 –	.99
Raw, tank cars (dom.)	gal.	.94 –	.95
Boiled, 5-bbl. lots (dom.)	gal.	1.02 –	1.04
Olive oil, denatured, bbl.	gal.	1.10 –	1.15
Palm, Lagos, casks	lb.	.08½ –	.08½
Palm kernel, bbl.	lb.	.08½ –	.09
Peanut oil, crude, tanks (mill)	lb.	.13½ –	.13¾
Peanut oil, refined, bbl.	lb.	.16½ –	.16¾
Rapeseed oil, refined, bbl.	gal.	.85 –	.86
Rapeseed oil, blown, bbl.	gal.	.90 –	.91
Soya bean (Manchurian), bbl.	lb.	.12 –	
Tank, f.o.b. Pacific coast	lb.	.10½ –	

Fish Oils

Menhaden, light pressed, bbl.	gal.	$0.68 –	.70
White bleached, bbl.	gal.	.72 –	.74
Blown, bbl.	gal.	.76 –	.78
Whale No. 1 crude, tanks, coast	lb.	.06 –	.06½

Dye & Tanning Materials

Divi-divi, bags	ton	$38.00 –	$39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Logwood, sticks	ton	28.00 –	30.00
Logwood, chips, bags	lb.	.02½ –	.03½
Sumac, leaves, Sicily, bags	ton	65.00 –	
Sumac, ground, bags	ton	55.00 –	60.00
Sumac, domestic, bags	ton	35.00 –	
Tapioca flour, bags	lb.	.03½ –	.05

EXTRACTS

Archil, conc., bbl.	lb.	$0.17 –	$0.18
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.08 –	.09
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.04 –	.05
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.14 –	.17
Logwood, crys., bbl.	lb.	.19 –	.20
Logwood, liq., 51°, bbl.	lb.	.09 –	.10
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ –	.05
Sumac, dom., 51°, bbl.	lb.	.06½ –	.07

Waxes

Bayberry, bbl.	lb.	$0.28 –	$0.30
Beeswax, refined, dark, bags	lb.	.30 –	.32
Beeswax, refined, light, bags	lb.	.34 –	.35
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.27 –	.29
Carnauba, No. 1, bags	lb.	.40 –	.41
No. 2, North Country, bags	lb.	.23½ –	.24
No. 3, North Country, bags	lb.	.19 –	.19½
Japan, cases	lb.	.15 –	.15½
Montan, crude, bags	lb.	.03½ –	.04
Paraffine, crude, match, 105-110 m.p.	lb.	.04 –	.04½
Crude, scale 124-126 m.p., bags	lb.	.02½ –	.02¾
Ref., 118-120 m.p., bags	lb.	.03½ –	.03¾
Ref., 125 m.p., bags	lb.	.03¾ –	.03¾
Ref. 128-130 m.p., bags	lb.	.04 –	.04¼
Ref., 133-135 m.p., bags	lb.	.04¼ –	.04½
Ref., 135-137 m.p., bags	lb.	.05 –	.05½
Stearic acid, agle pressed, bags	lb.	.13½ –	
Double pressed, bags	lb.	.14½ –	
Triple pressed, bags	lb.	.16 –	

Fertilizers

Ammonium sulphate, bulk, f.o.b. works	100 lb.	$3.20 –	$3.25
F.a.s. double bags	100 lb.	3.85 –	3.95
Blood, dried, bulk	unit	4.60 –	
Bone, raw, 3 and 50, ground	ton	30.00 –	35.00
Fish scrap, dom., dried, wks.	unit	5.00 –	5.10
Nitrate of soda, bags	100 lb.	2.60 –	2.65
Tankage, high grade, f.o.b. Chicago	unit	4.70 –	4.80
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 –	$4.50
Tennessee, 78-80%	ton	8.00 –	8.25
Potassium muriate, 80%, bags	ton	35.00 –	36.00
Potassium sulphate, bags	unit	1.00 –	

Crude Rubber

Para—Upriver fine	lb.	$0.33 –	$0.33½
Upriver coarse	lb.	.27½ –	.28
Upriver caucho ball	lb.	.29½ –	.30
Plantation—First latex crepe	lb.	.34½ –	.35
Ribbed smoked sheets	lb.	.34½ –	.35
Brown crepe, thin, clean	lb.	.31 –	.32
Amber crepe No. 1	lb.	.31 –	.32

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$450.00 –	$550.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	60.00 –	80.00
Asbestos, cement, f.o.b., Quebec	sh. ton	15.00 –	17.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00 –	20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 –	15.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	24.00 –	28.00
Barytes, crude f.o.b. mines, bulk	net ton	9.00 –	9.25
Casein, bbl., tech.	lb.	.11 –	.12
China clay (kaolin) crude, f.o.b. Ga.	net ton	7.00 –	9.00
Washed, f.o.b. Ga.	net ton	8.00 –	9.00
Powd., f.o.b. Ga.	net ton	13.00 –	20.00
Crude f.o.b. Va.	net ton	8.00 –	12.00
Ground, f.o.b. Va.	net ton	13.00 –	20.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	6.00 –	7.00
No. 2 pottery	long ton	5.00 –	5.50
No. 1 soap	long ton	7.00 –	7.50
No. 1 Canadian, f.o.b. mill	long ton	25.00 –	27.00
Graphite, Ceylon, lump, first quality, bbl.	lb.	.06 –	.06½
Ceylon, chip, bbl.	lb.	.05 –	.05½
High grade amorphous crude	ton	35.00 –	50.00
Gum arabic, amber, sorts, bags	lb.	.15 –	.16
Gum tragacanth, sorts, bags	lb.	.50 –	.60
No. 1, bags	lb.	1.75 –	1.80
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N. Y.	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl.	lb.	.05 –	.05½
Dom., ground, bbl.	lb.	.06 –	.07
Shellac, orange fine, bags	lb.	.82 –	.83
Orange superfine, bags	lb.	.84 –	.85
A. C. garnet, bags	lb.	.79 –	.80
T. N., bags	lb.	.80 –	.81
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill.	ton	17.00 –	17.50
Silica, bldg. sand, f.o.b. Pa.	ton	2.00 –	2.75
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 –	9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	16.00 –	20.00

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	ton	$45–50
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40–46
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	36–41
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	42–44
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	$200.00 –	$225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.11½	.11¾
4-6% C	lb.	.12 –	.13
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	110.00 –	112.00
Spiegeleisen, 19-21% Mn.	gr. ton	35.00 –	37.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	1.90 –	2.15
Ferrosilicon, 10-15%	gr. ton	38.00 –	40.00
50%	gr. ton	86.00 –	89.00
75%	gr. ton	150.00 –	160.00
Ferrotungsten, 70-80%, per lb. of W	lb.	$0.85 –	$0.90
Ferro-uranium, 35-50% of U. per lb. of U	lb.	6.00 –	
Ferrovanadium, 30-40%, per lb. of V	lb.	3.75 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$6.50 –	$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	18.50 –	19.00
Coke, fdry., f.o.b. ovens	ton	8.25 –	8.50
Coke, furnace, f.o.b. ovens	ton	7.00 –	7.25
Fluorspar, gravel, f.o.b. mines' Illinois	ton	21.50 –	
Ilmenite, 52% TiO_2	lb.	.01½ –	.01¾
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.33 –	
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 –	.70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl seaport	unit	.11½ –	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½ –	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12	
Rutile, 95% TiO_2	lb.	.12 –	
Tungsten, scheelite, 60% WO_3 and over, per unit WO_3	unit	8.50 –	8.75
Tungsten, wolframite, 60% WO_3 and over, per unit WO_3	unit	8.00 –	8.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 –	2.50
Vanadium pentoxide, 99%	lb.	12.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.04½ –	.13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	16.75–17.00
Aluminum, 98 to 99%	24.00
Antimony, wholesale, Chinese and Japanese	7.65–7.75
Nickel, virgin metal	25.00–27.00
Nickel, ingot and shot	29.00
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	46.75–47.25
Lead, New York, spot	8.25
Lead, E. St. Louis, spot	8.30–8.40
Zinc, spot, New York	7.80–7.90
Zinc, spot, E. St. Louis	7.50–7.75

OTHER METALS

Silver (commercial)	oz.	$0.67
Cadmium	lb.	1.15
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	2.65@2.85
Magnesium, ingots, 99%	lb.	1.00@1.05
Platinum	oz.	110.00
Iridium	oz.	260.00@275.00
Palladium	oz.	79.00
Mercury	75 lb.	69.00@70.00

FINISHED METAL PRODUCTS

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	20.75
Copper bottoms	30.75
Copper rods	20.50
High brass wire	19.50
High brass rods	17.00
Low brass wire	21.10
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	29.00
Seamless copper tubing	25.25
Seamless high brass tubing	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	11.30@11.50
Copper, heavy and wire	11 25@11.50
Copper, light and bottoms	9.25@ 9.50
Lead, heavy	5.75@ 6.00
Lead, tea	3.50@ 3.75
Brass, heavy	6.25@ 6.40
Brass, light	5.35@ 5.75
No. 1 yellow brass turnings	6.30@ 6.50
Zinc	3.50@ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.29	$3.14
Soft steel bars	3.19	3.04
Soft steel bar shapes	3.19	3.04
Soft steel bands	3.29	3.19
Plates, ¼ to 1 in. thick	3.29	3.14

Industrial

Financial, Construction and Manufacturers' News

Construction and Operation

Alabama

HOLT—The Central Iron & Coal Co. has awarded a general contract to the Ingalls Iron Works, Birmingham, for the erection of a new 1-story plant for the manufacture of cast iron and steel pipe. The estimated cost is reported in excess of $80,000.

BIRMINGHAM—The Alabama Hide & Tallow Co., 1608 9th Ave., North, has plans in progress for the rebuilding of its tallow and grease works recently destroyed by fire with loss of about $18,000. Additional equipment will be installed. Charles Barber heads the company.

SHEFFIELD—The Alaten Lead Products Co., recently organized, has plans under way for the construction of a new plant for the manufacture of lead battery plates and other lead specialties.

BIRMINGHAM—The Sanitary Chemical Co., recently organized, has plans under consideration for the immediate establishment of a local plant for the manufacture of a line of chemical specialties. F. T. Bell heads the company.

EAST BIRMINGHAM—Following the completion of the first unit of its new pipe manufacturing plant, the McWane Cast Iron Pipe Co., Birmingham, is perfecting plans for the construction of another unit. It is purposed to increase the size of the present foundry, 108x340 ft., to a length of 540 ft. The initial plant will have a rated daily output of 8,000 ft. of cast-iron pipe, giving employment to about 150 men. J. R. McWane is president, and James D. Sample, vice-president.

California

SAN FRANCISCO—The National Lead Co., 485 California St., has awarded a contract to Dyer Brothers, Golden West Iron Works, Kansas St., for the erection of a new 1-story plant at 47th Ave. and East 10th St., Oakland, to cost about $37,000.

SAN FRANCISCO—The Jewell Steel & Malleable Co., 1375 Potrero Ave., has awarded a contract to Barrett & Hilp, 918 Harrison St., for the erection of a 1-story addition to its plant to cost about $13,000, exclusive of equipment.

Connecticut

SOUTH COVENTRY—The Willimantic Paper Co. is making ready for operations at the plant formerly occupied by the South Coventry Paper Co., recently acquired, and a number of alterations and improvements will be carried out. It is expected to commence producton before the close of the month.

Florida

SEBRING—The Town Council is considering the installation of a filtration plant and system at the municipal waterworks, comprising the former plant of the Sebring Light & Water Co., lately acquired for municipal property. Joseph Rawthorne is superintendent.

Georgia

ATLANTA—The Atlanta Glass Mfg. Co. has acquired a local site and plans for the erection of a new plant for the manufacture of glass bottles and other containers.

WRENS—The McNair-Young Oil Co. has tentative plans under consideration for the rebuilding of its local oil plant, partly destroyed by fire, Feb. 23, with loss approximating $50,000, including equipment.

TIFTON—The plant of the Tift Silica Brick Co. has been acquired by W. W. Pace, Jr., together with a large tract of adjoining property. The new owner will take possession immediately, and plans for general improvements for increased production. The plant will specialize in the manufacture of white silica bricks.

FORT VALLEY—The Emergency Products Co., recently organized, is planning for the establishment of a local plant for the manufacture of insect powders and kindred chemical specialties. Edward Chambers heads the company.

Indiana

EAST CHICAGO—Following a consummation of the proposed merger of the Youngstown Sheet & Tube Co., Youngstown, O., and the Steel & Tube Co. of America, Chicago, Ill., under the direction of the first-noted organization, plans are being perfected for extensions and improvements in the Steel & Tube Co. plants at East Chicago and Indiana Harbor. A number of new mills will be built. The project is estimated to cost in excess of $5,000,000, with machinery.

INDIANAPOLIS—The Chandler & Taylor Co., South Addison St., is planning for the rebuilding of its 1-story foundry, 175x300 ft., destroyed by fire, Feb. 24, with loss estimated at $85,000, including equipment. The new structure will be approximately the same size. The company manufactures steam engine boilers and kindred products. William M. Taylor is president.

Iowa

MASON CITY—The Cerro Gordo Brick & Gravel Co. is considering plans for the construction of a new brick-manufacturing plant, estimated to cost approximately $40,000. C. I. Snyder is secretary.

Kansas

WICHITA—The Western Glass Co., 531 North Market St., has taken bids on a general contract and will soon make award for the erection of a new 2-story and basement building, 75x130 ft., estimated to cost about $35,000. Edward Forsbloom, Sedgwick Bldg., is architect.

Louisiana

NEW IBERIA—The local Chamber of Commerce is considering plans for the establishment of a sugar refinery in or near the city. The Parish Farm Bureau, headed by A. A. Theriot and Louis Pesson, is also interested in the project. It is purposed to select an engineer to prepare plans in the near future.

Maryland

BALTIMORE—Plans are being completed for the erection of a 1-story foundry at the plant of the Bartlett-Hayward Co., Scott and McHenry Sts., manufacturer of machine castings, etc. Parker, Thomas & Rice, Union Trust Bldg., are architects.

HAGERSTOWN—The Elestano Mining Co., 3 Hamilton Row, is planning for the installation of smelting equipment at its new tin ore plant now being established. The company was recently incorporated.

Massachusetts

SPRINGFIELD—The Springfield Gas Light Co. will make extensions and improvements at the purifier building at its local artificial gas plant to cost $23,000. Plans have been completed.

BOSTON—The Penn Metal Co., 65 Franklin St., has purchased the local plant and business of the Midvale-Cambria Steel Co., Philadelphia, Pa., covering primarily the steel rod and bar branch of production. The new owner will continue the operation of the mill pending the completion of a new steel rod mill at its own plant, now in course of erection, and later will remove the Midvale works to this location. Expansion in production is planned.

Michigan

MARINE CITY—Sidney C. McLouth is planning for the immediate rebuilding of his foundry, partially destroyed by fire, Feb. 21, with loss estimated at $25,000, including equipment. The plant is devoted primarily to the production of steel castings.

WYANDOTTE—The Michigan Alkali Co., operated by the J. B. Ford Co., has tentative plans under consideration for the erection of a new 2-story plant on Biddle St.

HOLLAND—F. B. Parish has acquired the local foundry of the Holland Engine Co., and will operate the plant as an individual enterprise for the production of iron and steel castings. Extensions and improvements are planned to include the installation of additional equipment.

Missouri

ST. CHARLES—The Crucible Oil & Refining Co., St. Joseph, Mo., has preliminary plans in progress for the construction of a local refining plant, to include a byproducts department for the production of miscellaneous oils. The company also operates a works at Wichita, Kan.

ST. LOUIS—Tentative plans are being prepared for the construction of a new 1-story foundry at the plant of the Green Car Wheel Mfg. Co., 3000 North Broadway. Klipstein & Rathran, Chemical Bldg., are architects.

ST. LOUIS—The Frictionless Metal Co. has leased property at Cass Ave. and Collins St., comprising a 3-story building, for the establishment of a new plant for the manufacture of babbitt metal. The installation of machinery will be commenced at an early date. The company is now operating a plant at Richmond, Va., as well as a Canadian branch at Montreal, Que., and it is purposed to remove both of these plants to the new location at a later date. C. W. Bourne is president.

Montana

GREAT FALLS—The Sunburst Refining Co., recently organized with a capital of $300,000 as a subsidiary of the Sunburst Oil & Gas Co., is perfecting plans for the construction of a new oil-refining plant on local site, with initial capacity of about 4,000 bbl. per day. It is estimated to cost close to $150,000 with machinery. L. C. Stevenson is president of the parent organization and heads the new company. W. M. Parker is construction engineer in charge.

EAST HELENA—The American Smelting & Refining Co., 120 Broadway, New York, has plans in preparation for the construction of an addition to its local smelting plant, estimated to cost approximately $200,000, including equipment. The extension will be used to handle the increased output from the Hercules and Tamarack mines in the Cœur d'Alene district.

New Jersey

TRENTON—The Trenton Potteries Co., manufacturer of sanitary ware, will immediately commence construction of a 4-story addition to its Equitable Pottery at Lalor and Hancock Sts. A 1-story kiln building will also be constructed. The new structures will cost about $80,000. S. W. Mather & Sons, Greenwood and Canal Sts., have the general building contract.

NEWARK—The Electrified Water Co. has leased the 1-story building at 232 Halsey St. for the establishment of a new plant for the production of water-purifying materials and water-purification systems. The company is operating a number of plants in different parts of the country, and purposes to establish a new works at Los Angeles, Cal. Alfred H. Brundage is president.

NEWARK—The Celluloid Co., 290 Ferry St., has filed plans for the erection of a 1-story addition to its plant at 65-67 Westcott St., estimated to cost approximately $14,000.

BLOOMINGDALE—The Seamless Rubber Co., recently organized, has commenced the installation of machinery in a local building for the establishment of a new plant for the manufacture of hard rubber goods. It is purposed to inaugurate production at an early date.

JERSEY CITY—The Ault & Wiborg Co., 12th St., manufacturer of printing inks, etc., has filed plans for alterations and extensions in its local plant, to cost about $9,000.

TRENTON—George L. Atkins, Langhorne, Pa., has acquired the local foundry of the Reeves Foundry Co., Ward Ave., at a sheriff's sale for a consideration of $72,717. The plant has been closed for a number of months past. The new owner is said to be arranging for the organization of a company to operate the foundry for the production of iron and steel castings.

New York

BUFFALO—The City Council is arranging a bond issue of $2,800,000, of which amount $1,700,000 will be used for the installation of the proposed new filtration plant at the municipal waterworks.

NEW YORK—The Harlem Sugar Co., 2445 8th Ave., has completed plans for the construction of a new 2-story building, 75x100 ft., on the Southern Blvd., near St. Ann's

Ave., estimated to cost about $75,000. Charles Clark, 441 East Tremont Ave., is architect.

BUFFALO—The Federal Concrete Products Co. has made application to the City Council for permission to build a new plant at Kensington and Wyoming Aves., for the manufacture of cement and concrete products, to consist of a main 1- and 2-story building, 80x110 ft., and adjoining structure, 24x67 ft., estimated to cost approximately $30,000, with equipment. Walter E. Jones is president.

North Carolina

BELMONT—The Continental Brick & Tile Co., Chapel Hill, N. C., has commenced the erection of a new plant at Belmont for the manufacture of brick and tile products. Initial production will be devoted to brick, with output of about 30,000 per day. J. G. Gullick is president.

Ohio

LISBON—The American Vitrified Products Co. is said to be planning for the early rebuilding of the portion of its plant destroyed by fire, March 2, with loss estimated at about $100,000, including equipment.

Oklahoma

SAPULPA—The Star Gasoline Co., has commenced the construction of a new gasoline absorption plant in the Boggy farm section, to be equipped for an initial output of 2,500 gal. per day.

Pennsylvania

LOCK HAVEN—The Harbison-Walker Refractories Co., Farmers' Bank Bldg., Pittsburgh, is said to have preliminary plans under consideration for the construction of a new firebrick and refractory manufacturing plant in the vicinity of Lock Haven.

SHARON—The Sharon Brick & Clay Co., recently organized by H. D. Beegle, New Galilee, Pa., and associates, has taken over the local plant and business of the Sharon Clay Products Co., secured for a consideration of about $100,000. The new company plans for immediate operations and will make improvements and extensions to develop an output of about 250,000 bricks a week.

PHILADELPHIA—The Philadelphia Salt Co., Delaware and Oregon Aves., manufacturer of chemical products, has filed plans for the erection of a new 1-story plant addition, estimated to cost $20,000.

BOWMANSTOWN—The Aluminum Pigment & Products Co., Bowmanstown, recently organized, will locate its proposed new plant at this place instead of at Lehighton, Pa., as previously announced. A general contract for the building has been awarded to Charles Fenstermacher, Lehighton, and a portion of the initial equipment installation will be handled by the Fuller Lehigh Co., Fullerton, Pa. The plant will be devoted to the manufacture of aluminum pigments.

NEWCASTLE—The Grasselli Power Co. has tentative plans under consideration for the rebuilding of its press mill, recently destroyed by fire. The estimated loss has not been announced. Headquarters of the company are in the Guardian Bldg., Cleveland, Ohio

Tennessee

KNOXVILLE—The Cherokee Brick Co. has purchased a tract of more than 20 acres of land in the Chestnut Ridge section, and plans for the early erection of a new brick-manufacturing plant, with initial daily output of about 40,000 bricks. The company was organized recently with Roy Newman as president, and J. C. Wright, secretary and treasurer.

ERWIN—The Southern Potteries Co., recently taken over by new interests, has tentative plans under consideration for the construction of a new unit, comprising about seven kilns, with various production departments. Other improvements will be made at the pottery for increased output. Charles W. Foreman heads the company. G. F. Brandt is in charge of factory production.

Texas

DALLAS—The Standard Spring & Axle Co., 2614 Main St., will install a heat-treating department at its new plant at 2816 Main St., on which work has been commenced. L. K. Weaver is president and treasurer.

SAN ANTONIO—The Kahn Oil Co. is planning for the installation of a new laboratory at its plant. C. H. Nunn is chemist, in charge.

Industrial Developments

CERAMIC—The Crescent China Co., Alliance, O., is advancing production at its pottery and has commenced operations at the new 7-kiln plant, recently completed. The pottery will run full for an indefinite period.

The Auburn Shale Brick Co., Auburn, Pa., is arranging for early curtailment at its plant for necessary machinery repairs and plant improvements. The plant will be closed for a few weeks and will then resume on a full capacity schedule.

The Andalusia Brick Co., River Falls, Ala., is operating at full capacity and plans are under consideration for improvements to provide for greater output. The company was recently acquired by new interests, headed by C. L. Benson.

The E. H. Sebring China Co., Sebring, O., is running at full capacity with full working force, and will continue on this basis for an indefinite time. The company has plans under consideration for the construction of two additional kilns at the pottery.

The Hazleton Brick Co., Hazleton, Pa., is making a number of improvements at its plant, including repairs to machinery, and plans to resume production early in the spring, giving employment to a full working force.

The Gratztown Brick Works, West Newton, Pa., recently acquired by new interests, has resumed production after a shutdown for about 24 months. It is expected to maintain capacity operations for a number of months to come. Eugene Servi heads the new company.

Lenox, Inc., Trenton, N. J., manufacturer of fine chinaware, has added a number of employees to its working force, including former operatives recently on strike, who have returned on an open shop basis, as lately established by the company. Operations are close to normal and will be maintained on this basis.

RUBBER—The Traveler Rubber Co., Bethlehem, Pa., is operating at full capacity with normal working force. Incoming orders are in excess of the plant output and it is currently estimated that the company is now about 35,000 tires behind in deliveries. Preliminary plans are under consideration for enlargements in the plant.

In connection with proposed plans for maximum spring production, the Goodyear Tire & Rubber Co., Akron, O., has increased immediate output from 28,000 to 30,000 a day. The mill is now giving employment to close to 14,000 workers. Manufacture will be further advanced as soon as additional employees are available.

The B. F. Goodrich Co., Akron, O., has increased production in the tire departments at its mills from 18,000 to 20,000 tires per day. A full working quota is being employed.

CEMENT—The Coplay Cement Co., Coplay, Pa., has resumed production at its Mill "B" following a shutdown for several weeks past, owing to necessary repairs and alterations in machinery. It is expected to develop capacity at an early date, with full working force.

The Signal Mountain Portland Cement Co., Chattanooga, Tenn., is pushing construction on its new local mill, and expects to commence production late in April or early in May giving employment to a large working force. The plant represents an investment of close to $2,000,000.

According to statistics compiled by the Portland Cement Association, mills throughout the country are running better than 65 per cent capacity, gross, an increase of 80 per cent as compared with this same time a year ago.

IRON AND STEEL—The Replogle Steel Co., New York, is making repairs at its large blast furnace at Catasauqua, Pa., including relining, with day and night working forces. The stack is expected to be ready for resumption within a few weeks.

The Wheeling Steel Corp., Wheeling, W. Va., has blown in its Top Mill blast furnace, following a suspension since last August. The stack will give employment to about 100 men. All plant units of the company are now on the active list, operating at close to 75 per cent of normal.

The wages of puddlers and rollers in the Youngstown, O., district have been advanced 2.1 per cent and 2.5 per cent, respectively.

The Ulster Iron Works, Dover, N. J., are making ready to resume production at their puddling mills on West Clinton St. Plans are under way for extensions in the plant, to include the installation of two more furnaces and the erection of a mill to cost approximately $100,000. The working force is being increased in the different departments.

A total of 50 out of 51 steel mills are now in operation in the Niles, O., district, the single mill being that of the Mahoning Valley Steel Co., a shutdown of the unit being necessary on account of a breakdown. It is expected to be on the active list within a few weeks.

MISCELLANEOUS—The Scott Paper Co., Philadelphia, Pa., is maintaining capacity production at its mills at Chester, Pa., with employment of full working force. This shedule will be maintained indefinitely.

The Tennessee Copper & Chemical Co., 61 Broadway, New York, has opened its new acid phosphate plant at Cincinnati, O., and will develop capacity production immediately. It is said that the entire spring production of the new unit has already been completely sold.

The Atlas Mineral Products Co., Mertztown, Pa., manufacturer of paint specialties, is running full with regular working force. It is stated that orders on hand insure the continuance of this schedule for at least 6 months to come.

The Mathieson Alkali Works, Providence, R. I., is now operating at about 90 per cent of maximum capacity, as compared with less than 75 per cent at this same time a year ago.

New Companies

THE CAMEL CHEMICAL CO., Portland, Ore., has been incorporated with a capital of $25,000, to manufacture chemicals and chemical byproducts. The incorporators are C. W. Hall, W. B. Potter and George J. Dreis. The company is represented by S. S. Johnson, 909 Wilcox Bldg., Portland.

THE BURROWLITE NICKEL STEEL CO., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws with capital of $1,000,000, to operate a metal smelting and refining plant.

THE WAGGONER REFINING CO., Electra, Tex., has been incorporated with a capital of $300,000, to manufacture refined petroleum products. The incorporators are W. T., E. P., and G. L. Waggoner, all of Electra.

THE MID-WEST WALL PAPER MILLS, INC., Fuller Tract, Logan Ave., Joliet, Ill., has been incorporated with a capital of $95,000, to manufacture paper products. The incorporators are William E. Lamb, William M. Kearney and Thomas J. Reardon.

THE FUNDY PAINT CO., Brooklyn, N. Y., care of E. N. Baar, 51 Chambers St., N. Y., representative, has been incorporated with a capital of $20,000, to manufacture paints, varnishes, etc. The incorporators are E. R. Bagarozy and M. Craushaar.

THE SPRINGFIELD BRICK CO., Springfield, Mass., has been incorporated with a capital of $97,500, to manufacture brick, tile and other burned clay products. Clayton H. Goodell is president; and Harold E. Clark, treasurer, both of Springfield. The last noted represents the company.

THE ANGLO-AMERICAN ANILINE & CHEMICAL WORKS, INC., care of the Colonial Charter Co., Ford Bldg., Wilmington, Del., representative, has been incorporated under Delaware laws with capital of $450,000, to manufacture chemicals and chemical byproducts, dyes, etc.

THE SWATARA CHEMICAL CO., Hummelstown, Pa., has been incorporated with a nominal capital of $5,000, to manufacture chemicals and chemical byproducts. William Karmany, Hummelstown, is treasurer.

THE WEST VIRGINIA CHEMICAL CO., Fairmont, W. Va., has been incorporated with a capital of $25,000, to manufacture chemicals and chemical byproducts. The incorporators are J. M. Moran and H. H. Curry, both of Fairmont.

THE INTERNATIONAL PRODUCTS CO., 333 Ardmore Ave., Trenton, N. J., has been incorporated with a capital of $50,000, to manufacture paints, varnishes, etc. The incorporators are John R. Turner, Alfred F. McCabe and Charles J. Hofman.

THE COLUMBIAN COLOR & CHEMICAL CO., Brooklyn, N. Y., care of Gilroy & Hyman, Woolworth Bldg., representatives, has been incorporated with a capital of $20,000, to manufacture chemical products, colors and affiliated specialties. The incorporators are J. J. and F. J. Sullivan, and J. R. Cusack.

THE ELLWOOD BRICK & TILE CO., care of Delaware Registration Trust Co., 900 Market St., Wilmington, Del., representative, has been incorporated under Delaware laws with capital of $75,000, to manu-

facture brick, tile and other burned clay products.

THE MARSHALL REFINING CO., 332 South Michigan Ave., Chicago, Ill., has been incorporated with a capital of $100,000, to manufacture petroleum products. The incorporators are Frank Sullivan, Harry N. Weinberg and Paul M. Godehn.

THE MONESS CHEMICAL CO., New York, care of A. M. Silverman, 276 5th Ave., representative, has been incorporated with a capital of $10,000, to manufacture chemicals and chemical byproducts. The incorporators are J. M. and E. Moness, and L. D. Malin.

THE BROOKS CHEMICAL CO., New Cumberland, W. Va., has been incorporated with a capital of $15,000, to manufacture chemicals, compounds, etc. The incorporators are C. L. Gray, John R. Platinburg and George W. McNeil, all of New Cumberland.

THE LINSEED OIL PRODUCTS CO., Philadelphia, Pa., has been incorporated with a nominal capital of $5,000, to manufacture linseed oil and other oil products. J. H. Webster, 34 East Willow Grove Ave., Philadelphia, is treasurer.

THE MANNING FERTILIZER CO., Manning, S. C., has been incorporated with a nominal capital of $50,000, to manufacture fertilizer products. Charlton Durant is president; and C. R. Sprott, secretary and treasurer, both of Manning.

Industrial Notes

MCCLELLAN & JUNKERSFELD, INC., engineer and contractor, of Philadelphia and New York, has added to its staff N. B. Ambler, J. T. Brusky, Harrison E. Kieffel and Thomas Richardson. Renshaw Borie has also recently been added to the staff and is in charge of the Philadelphia office at 112 South 16th Street.

THE CUTLER STEEL CO., of Pittsburgh, announces the appointment of W. F. Furman as district manager, with headquarters at 50 Church St., New York. Mr. Furman was for many years with the American Locomotive Co. and more recently the Eastern representative of the LeMoyne Steel Co., of Pittsburgh. The general sales office of the company, which has been maintained for the past 2 years at 50 Church St., New York City, has been transferred to the Bowman Bldg., Pittsburgh, Pa. W. H. Waddington, vice-president in charge of sales, will make his headquarters at the Pittsburgh address.

THE UEHLING INSTRUMENT CO., Paterson, N. J., has placed Royal E. Terhune in charge of the northern New Jersey sales territory. Mr. Terhune was formerly associated with the Uehling laboratories. John E. Arnold, 15½ South 4th St., Tulsa, Okla., has been appointed an agent for the Oklahoma territory and H. R. N. Johnson, 917-A Marquette Ave., Minneapolis, has been appointed agent for the Minnesota, North Dakota and South Dakota territory. Walter C. Lange, 20 West Jackson Blvd., recently returned to the Chicago territory after 2 months spent at the Paterson plant, assisting in the development of the new Uehling CO, or combustible, recorder. This company also announces that it has appointed Mitsui & Co. representatives in Japan and China for Uehling CO_2 recording equipment and other Uehling power plant instruments and gages. The head office of Mitsui & Co. is located in Tokio and their New York branch is at 65 Broadway.

THE WEBSTER MFG. CO., of Chicago, Ill., and Tiffin, O., announces further expansion in connection with its Canadian business by starting a new corporation—Webster-Inglis, Ltd.—which will be located at 14 Strachan Ave., Toronto, Ont., Canada. The facilities of this plant will enable the company to design and manufacture elevating, conveying and power transmission machinery along the same lines as are now manufactured by the Webster Mfg. Co.

THE HARRISBURG MFG. & BOILER CO., of Harrisburg, Pa., recently opened a sales office in the Park Row Bldg., New York City. The company builds boilers, tanks, steel stacks, breechings and special steel plate and structural steel jobs. It also has large machine shops and makes a specialty of contracting to build entire lines of machinery for companies not having their own shops.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces that Clyde M. Carr has retired as president, on account of poor health. He has not taken an active part in the management of the firm for the past 2 years. He will continue, however, as a director. At the regular annual meeting of the directors, Joseph T. Ryerson was elected president, Joseph T. Ryerson, the grandson of the original Joseph T., succeeds to the presidency with a background of 22 years in the steel business. He was born in 1880 and immediately after graduating from Yale in 1901 went to work for the American Sheet Steel Co., now the American Sheet & Tin Plate Co., at its mill in Vandergrift, Pa. In October, 1902, he started with Joseph T. Ryerson & Son at Chicago and in 1904 was elected treasurer, becoming vice-president in 1922.

THE COMBUSTION ENGINEERING CORP., New York, announces that T. J. Cleary, who has recently opened an office in Atlanta, Ga., for the sale of power plant equipment, has been appointed its Southern agent. Communications should be addressed to Room 702, Candler Bldg. Atlanta, Ga.

THE KEWANEE BOILER CO. is now located in its new building at 822 West Washington St., Chicago.

THE NATIONAL ANILINE & CHEMICAL CO., INC., announces that E. L. Rimbault, formerly reclamation manager of the company, at the Buffalo plant, has been appointed manager of the intermediates and certified food color divisions. Mr. Rimbault will be located at the main office of the company at 40 Rector St., New York City.

THE MONSANTO CHEMICAL WORKS, St. Louis, Mo., announces that at its annual meeting on Jan. 15 the stockholders elected the following directors to serve during 1923: John F. Queeny, Gaston Du Bois, Beverly D. Harris, Edgar M. Queeny, H. O. McDonough, Joseph D. Lumaghi and Theodore Rassieur. At the directors' meeting immediately following, the officers were elected as follows: Chairman of the board, John F. Queeny, president, Beverly D. Harris; first vice-president, Gaston Du Bois; second vice-president, Edgar M. Queeny; third vice-president, Frank L. McCartney; treasurer, H. G. Gunther; secretary, W. R. Phemister; assistant secretary, C. A. Zacher. Frank L. McCartney's title is now vice-president in charge of sales, while Edgar M. Queeny is vice-president and assistant general manager.

DWIGHT P. ROBINSON & CO., INC., New York, has added as consulting materials engineer C. L. Chapman. Mr. Chapman, who has been active in the work of the American Society of Testing Materials and the American Concrete Institute, will, in the future, represent Dwight P. Robinson & Co. in the committee work of these societies.

THE POWER SPECIALTY CO. announces that Paul T. Buckler, for 14 years with the Detroit Stoker Co. as manager successively of the Pittsburgh, Cleveland and New York offices, is now in its New York Office, assisting in the sale of Foster superheaters and economizers.

THE WESTERN PRECIPITATION CO., Los Angeles, Calif., has moved its Eastern office from Philadelphia to New York City. This applies as well to the office of the subsidiary company, the International Precipitation Co. The Eastern office is now in the same quarters as those occupied by the company's associate, the Research Corporation, at 25 West 43rd St.

THE CONVEYORS CORP. OF AMERICA, Chicago, Ill., announces the acquisition from the Green Engineering Co., East Chicago, Ind., of all rights to the Green steam jet ash conveyor, the transaction having become effective Feb. 1. It acquires all the patterns, patents and manufacturing rights pertaining to the Green conveyor. All orders for replacement parts and extensions to the Green conveyor will be filled by the Conveyors Corp. of America.

THE ELECTRO BLEACHING GAS CO., manufacturer of liquid chlorine, announces the advancement to general sales manager of S. W. Jacobs, succeeding D. K. Bartlett, resigned. Mr. Jacobs is a chemical engineer and has supervised the installation of a number of chlorine plants. His office will continue to be at the main office of the company, 18 East 41st St., New York City.

THE HARRISBURG PIPE & PIPE BENDING CO., Harrisburg, Pa., at a meeting of the board of directors, elected Christian W. Lynch president and director of the company, to fill the vacancy caused by the resignation of Alfred K. Barker. Mr. Lynch up to the last year was president and general manager of the Harrisburg Foundry & Machine Co., Harrisburg, Pa., and prior to that was for many years president and general manager of the W. O. Hickok Mfg. Co., Harrisburg, Pa.

THE MERRIMAC CHEMICAL CO., 148 State St., Boston, Mass., announces that it has added to its list of products the following: Mercior, a bleach and disinfectant to be used in laundries, dairies, freight cars, markets, etc., and acetic acid in strengths from 56 per cent to glacial.

THE NEW YORK TESTING LABORATORIES, New York City, has installed a new automatic 100,000 lb. Tinius Olsen testing machine for handling of tensile tests, compression tests, transverse tests, etc.

THE ALEXANDER MILBURN CO., of Baltimore, Md., manufacturer of oxy-acetylene welding and cutting equipment, has recently placed on the market an addition to its line, viz., a portable acetylene welding generator designed to obviate the use of high-pressure cylinders. The company says: "The generator is of 30 lb. carbide capacity, or equivalent of 150 cu.ft. cylinder gas. It is simple to operate, having few parts, operates automatically with no clock or motors; steel body welded throughout, and all parts easily 'get-at-able'."

Coming Meetings and Events

AMERICAN ASSOCIATION OF CEREAL CHEMISTS will hold its ninth annual convention at Hotel Sherman, Chicago, June 4 to 9.

AMERICAN ASSOCIATION OF ENGINEERS will hold its annual convention in Norfolk, Va., May 7 to 9.

AMERICAN CHEMICAL SOCIETY will hold its spring meeting April 3 to 7, 1923, at New Haven, Conn.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its spring meeting May 3, 4 and 5, 1923, at the Commodore Hotel, New York.

AMERICAN FOUNDRYMEN'S ASSOCIATION will hold a meeting in Cleveland, O., April 28 to May 4.

AMERICAN GAS ASSOCIATION will hold its annual convention the week of Oct. 15 at Atlantic City. An elaborate exhibition of gas-making and gas-utilization equipment is planned.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its summer meeting June 20-23 at Wilmington, Del.

AMERICAN LEATHER CHEMISTS ASSOCIATION will hold its twentieth annual convention at the Greenbrier, White Sulphur Springs, W. Va., June 7, 8 and 9.

AMERICAN OIL CHEMISTS' SOCIETY will hold its annual meeting at the Eastman Hotel, Hot Springs, Ark., April 30 and May 1.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-sixth annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, beginning Monday, June 25, 1923, and ending either Friday or Saturday of that week.

INTERNATIONAL CHAMBER OF COMMERCE will hold its second general meeting in Rome, Italy, March 19-26, 1923.

IRON AND STEEL INSTITUTE (London) will hold its annual meeting May 10 and 11 at the House of the Institution of Civil Engineers, London, S. W. 1.

NATIONAL ASSOCIATION OF MANUFACTURERS OF THE UNITED STATES OF AMERICA will meet in annual conference May 14 to 16, inclusive, at the Waldorf-Astoria, New York City.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH) will be held in New York Sept. 17-22.

NATIONAL FOREIGN TRADE COUNCIL has postponed its annual conference from April 25, 26 and 27, to May 2, 3 and 4. It will be held in New Orleans, La.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

FIFTH PAN-AMERICAN CONFERENCE will be held at Santiago, Chile, March 25, 1923.

SOCIETY FOR STEEL TREATING—Eastern sectional meeting will be held June 14 and 15, in Bethlehem, Pa.

SOCIETY OF INDUSTRIAL ENGINEERS, with headquarters in Chicago, will hold its spring convention in Cincinnati, April 18, 19 and 20, 1923. The major subject will be "Management Problems of the Smaller Plants."

A PAPER INDUSTRIES EXPOSITION will be held in Grand Central Palace, New York City, during the week of April 9, 1923, by the International Exposition Co.

The following meetings are scheduled to be held in Rumford Hall, Chemists' Club, East 41st St., New York City: March 23—Society of Chemical Industry, regular meeting. April 20—Society of Chemical Industry (in charge), American Electrochemical Society, Société de Chimie Industrielle, American Chemical Society, joint meeting. May 4—American Chemical Society, regular meeting. May 11—Société de Chimie Industrielle (in charge), American Chemical Society, American Electrochemical Society, Society of Chemical Industry, joint meeting. May 18—Society of Chemical Industry, regular meeting. June 8—American Chemical Society, regular meeting.